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Coping with Pollution: Eco-taxes in a GST Regime

D K Srivastava
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With inputs from
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MSE
Mentoring Excellence

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India

Phone: 2230 0304/ 2230 0307/2235 2157
Fax : 2235 4847 /2235 2155
Email : info@mse.ac.in
Website: www.mse.ac.in

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D.K.Srivastava
K S Kavi Kumar
C.Bhujanga Rao

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Chapter 1

INTRODUCTION

1.1 Context

India is targeting the introduction of a comprehensive value added tax under the name of a goods and services tax (GST) by April 1, 2011[1]. By now more than 140 countries have already adopted a value added tax and as such India will be a latecomer into the VAT club although a kind of fragmented VAT system[2] is already in place with the reform of indirect taxes since the early nineties. Many of the developed countries which had adopted VAT earlier are now introducing a conscious 'green shift' not only in their VAT but the entire tax structure so as to use economic instruments for achieving environmental objectives.

Since a major change in the system of taxation in India is being introduced, it is the appropriate time to also bring on board the environmental considerations. It is argued here that this will be welfare improving and facilitate the introduction of GST by allowing for a lowering of the overall GST rate, that is, the so-called revenue neutral rate (RNR), while taxing the environmental 'bads' at differentially higher rates. This will also give the Indian GST a forward looking orientation where incentives will be in place to encourage growth of environmental friendly industries rather than only correcting for past distortions.

1.2 Tackling Pollution: Constitutional Responsibilities

Protection and improvement of environment is a constitutional responsibility cast on every citizen, the state governments and the central government. Under the constitution, three important subjects concerning environment, namely, water, land, and gas and gas-works are placed in the State List of the Seventh Schedule of the Constitution as items 17, 18, and 25. Forests are in the Concurrent List. Under Article 48, protection and improvement of environment has been identified as state responsibility. This Article provides that the: 'the state shall endeavor to protect and improve the environment and

[1] Vide speech of Union Finance Minister while presenting Union Budget 2010-11.

2 Goods are taxed under Cenvat by the Central Government and State VAT by the State Governments. Services are taxed separately. Taxation of petroleum products is subjected to sales tax as well as central excise duty. There is a central sales tax on inter-state trade of goods.

to safeguard the forests and the wild life of the country.' The quality of environment has an important bearing on the right to life under Article 21 relating to the fundamental rights[1].

Under Article 249, Parliament can legislate on matters of 'national interest'. Two major and vital Indian environmental laws, namely, The Air [Prevention and Control of Pollution] Act of 1981 and The Environmental [Protection] Act of 1986, have been enacted under these Constitutional provisions. Article 51A(g) imposes a fundamental duty on the Indian citizen to protect and improve the natural environment, including forests, lakes, rivers and wildlife.

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[1] Any disturbance to the basic environment elements, namely, air, water, and soil necessary for life, would be hazardous to life within the meaning of article 21 of the constitution (M.C.Mehta vs Kamal Nath, AIR 2000, SC,1997)

Chapter 2

POLLUTION IN INDIA: DIMENSIONS AND SEVERITY

The main forms of pollution are atmospheric pollution, land degradation and soil pollution, water pollution, and noise pollution (see Appendix 1 for details). 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 and electrical power generating stations. Three main pollutants of ambient air quality are Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Particulate Matter. The main water pollutants are effluents and discharges from industries. The main land and soil pollutants are fertilizers and pesticides. Appendix 1 provides a detailed analysis of the sources, incidence, and extent of pollution at the national, state and where relevant, local level.

2.1 Air Pollution

In most of the Indian cities, the annual average concentrations of respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) reflecting presence of particulate matter exceed the National Ambient Air Quality Standards (see Char A1.1 in Appendix 1). The reasons for high particulate matter levels are vehicles, engine gensets, small scale industries, biomass incineration, boilers and emission from power plants, suspension of traffic dust, and commercial and domestic use of fuels.

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 had the highest share.

There is considerable inter-state variation in CO_2 emissions. State level CO_2 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. Table 1 provides the details. Per capita CO_2 emissions as per these figures show that 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 CO_2 emission of 450 metric tonnes. High per capita emissions may be due either to the state undertaking production of polluting material as in the case of Madhya Pradesh, Chhattisgarh, and Bihar or it may be due to high 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 CO_2 emissions are from coal. About 70 percent of the coal in India is consumed in the power sector.

Table 1: State level CO_2 Emissions: 2000

('000 metric tons of carbon)

Aggregate						
J&K	**HP**	**Punjab**	**Haryana**	**UP**	**Rajasthan**	**Delhi**
696.5	**659.1**	**10845.7**	**5460.5**	**44268.3**	**8929.3**	**6033.8**
Bihar	Orissa	WB	Assam	Gujarat	Maharashtra	Goa
9012	**16172.3**	**23363.7**	**1097**	**18461.5**	**35595.4**	**652.2**
MP	AP	Karnataka	Kerala	TN	Others	
39279.4	**30126**	**9059.6**	**3034.2**	**17584.9**	**43712.6**	
Per Capita						
J&K	HP	Punjab	Haryana	UP	Rajasthan	Delhi
0.07	**0.11**	**0.45**	**0.26**	**0.27**	**0.16**	**0.44**
Bihar	Orissa	WB	Assam	Gujarat	Maharashtra	Goa
0.11	**0.44**	**0.29**	**0.04**	**0.37**	**0.37**	**0.44**
MP	AP	Karnataka	Kerala	TN	Others	
0.66	**0.4**	**0.17**	**0.1**	**0.28**	**0.62**	

Source: Ghoshal and Bhattacharya (2007).

2.2 Land and Soil Pollution

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 districts of Mizoram, Maharashtra, Uttar Pradesh, West Bengal, Madhya Pradesh, Himachal Pradesh and Bihar have relatively higher percentage of soil erosion compared to the national average.

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 beneficiation of ores, crushing, screening, washing, cleaning, grading, milling floatation, melting floatation and other preparations at the mine site. In India, coal is the most important energy source but Indian coal has a low calorific value with ash content ranging from 40-50% as well as a high moisture content between 4-20% (Chikkatur & Sagar, 2007).

2.3 Water Pollution

Water is polluted by the effluents of industries. Some of the important industries in this context are ferrous and non-ferrous metallurgical industries, mining and ore processing, and industries relating to petroleum, petrochemicals, chemicals, ceramics, cement, textiles, paper, fertilisers, coal (including coke), power (thermal and diesel) generation, and processing of animal or vegetable products industry. Small scale industries (SSIs) are also a major source of industrial water pollution.

Both land and water are polluted because of excessive use of pesticides. An inter-state comparison of consumption of pesticides shows that, according to available data for 2004-05, the highest amount of pesticides was used in Punjab followed by Uttar Pradesh, Haryana, 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.

The presence of iron in water has affected the largest number of habitations in India. These habitations are 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.

Apart from the national and state-wise picture, a number of **environmental hotspots** in the country have also been identified calling for urgent policy intervention. The Blacksmith Institute of New York has been identifying the worst polluted places of the world on the basis of size of affected population, severity of the toxin involved, impact on children’s health and development, evidence of a clear pathway of contamination, and existing and reliable evidence of health impact. In the 2006 report, Ranipet in Tamil Nadu featured among the top ten worst polluted places[1]. Within five kilometer distance around 68 tanneries operate in Dindigul leading to severe ground water pollution. Tannery effluents are reported to have left only 16 out of 56 wells in Kamatchipuram village uncontaminated forcing people to walk long distances for water. The water and soil pollution from the tannery effluents has the potential to affect about 450,000 people. In the 2007 report, Sukinda valley in Orissa featured among the top ten worst polluted places. Sukinda valley contains about 97 percent of India's chromite ore deposits and is one of the world's largest open cast chromite ore mines. With over twelve mines still in operation, a large quantity of waste rock is spread over the surrounding areas and the Brahmani riverbank[2]. Besides these, the 2006 and 2007 reports also highlight other pollution hotspots of India including Kanpur (chemical pollutants from the tanneries), Ankleshwar (heavy metals and chemicals from the chemical units), Vapi (chemicals and heavy metals from the chemical units), Kolkata (lead pollution from lead factories producing lead ingots and lead alloys), and Mahad Industrial Estate in Karnataka (heavy metals and organic pollutants from the chemical units).

[1] While the state government had ordered closure of Tamil Nadu Chromates and Chemicals Limited a decade ago, the legacy of the same still continues with no solution still in sight for the safe disposal of 1,500,000 tons of solid waste generated by the factory over two decades before its closure. Blacksmith Institute and Asian Development Bank estimate that about 3.5 million people are potentially affected due to ground and surface water contamination.

[2] As untreated water is discharged by the mines into the river and onto the soil, more than sixty percent of the drinking water is reported to contain hexavalent chromium at levels that are far above the national and international standards. Of the 26,00,000 potentially affected population in the area, a local NGO has estimated that about 25 percent are affected by various pollution induced diseases.

Chapter 3

POLLUTION IN INDIA: IMPLICATIONS FOR GROWTH AND WELFARE

Pollution is an externality to economic activities associated with both production and consumption of goods and services. Pollution has serious implications for economic growth and welfare because of its impact on health, resource depletion, and natural calamities linked to climate change.

Pollution has local, regional, and global dimensions (as discussed in Section II and Appendix 1). The local effects are largely on air, soil, water and plants from industrial emissions and discharges, noise, and smell. The regional effects are due to eutrophication, contaminants in the soil and water, and landscape changes due to mining or agriculture. The global effects relate to changes in the climate due to ozone depletion and the green house effect. Accordingly, policies for controlling pollution and mitigating its impact need to have national, state-level and local dimensions.

With respect to the global dimension, climate change is linked to green house gases. India's contribution to carbon emissions in per capita terms[1] is still much less than many of the developed countries but its aggregate contribution is the fourth highest after China, US, and Russia. 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 substantial increase in coal use in these two countries along with rapid economic growth. 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 global terms, there is an asymmetry between who have been relatively more responsible for the adverse impact on climate and who will face the relatively more adverse consequences. Effects on India will be disproportionately larger as compared to

[1] A number of modeling exercises facilitated by the MOEF highlight that India's per capita GHG emissions in 2030-31 would be between 2.77 tonnes and 5.00 tonnes of CO_2e (Carbon Dioxide equivalent). Four of the five studies estimated that even in 2031, India's per capita GHG emissions would stay under 4 tonnes of CO_2e which is lower than the global per capita emissions of 4.22 tonnes of CO_2e in 2005. This would mean that even two decades from now, India's per capita GHG emissions would be well below the global average of 25 years earlier.

its contribution to global carbon emissions. According to the Geological Survey of India[1], 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.

Pollution, however, is a concern broader than the issue of climate change. The health hazards related to pollution affect quality of life, productivity of population, loss of work days and use of resources for treatment of chronic diseases. Data from the Central Pollution Control Board (CPCB) and other sources shows that the environmental pollution – water, air as well as solid waste – has been in excess of the national ambient standards at several places across India. For instance, the water pollution levels measured in terms of biochemical oxygen demand (BOD) in several rivers is well above the water quality criteria. Similarly the respirable suspended particulate matter (RSPM) critically important from the viewpoint of health has been well above the national ambient air quality standard in several monitoring stations. The following charts give a snapshot picture of the status of the environmental pollution. Chart 1 shows the position of water pollution and Chart 2 that of air pollution compared to the relevant benchmarks across various monitoring sites/stations in India in mid-2000s.

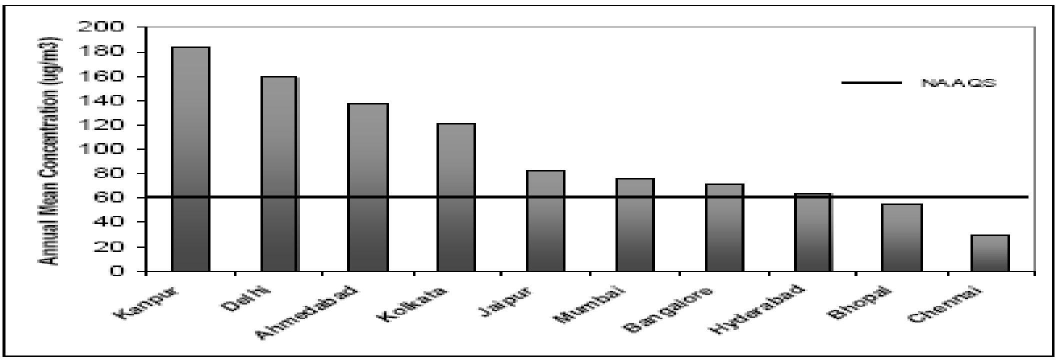

Chart 1: Status of Water Pollution across India – Mid-2000s

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[1] Geological Survey of India (2005). While it is acknowledged that the Himalayan glaciers are receding, a recent MOEF Discussion Paper (2009) argues that this could be due to various factors and the link with climate change is not that clear cut.

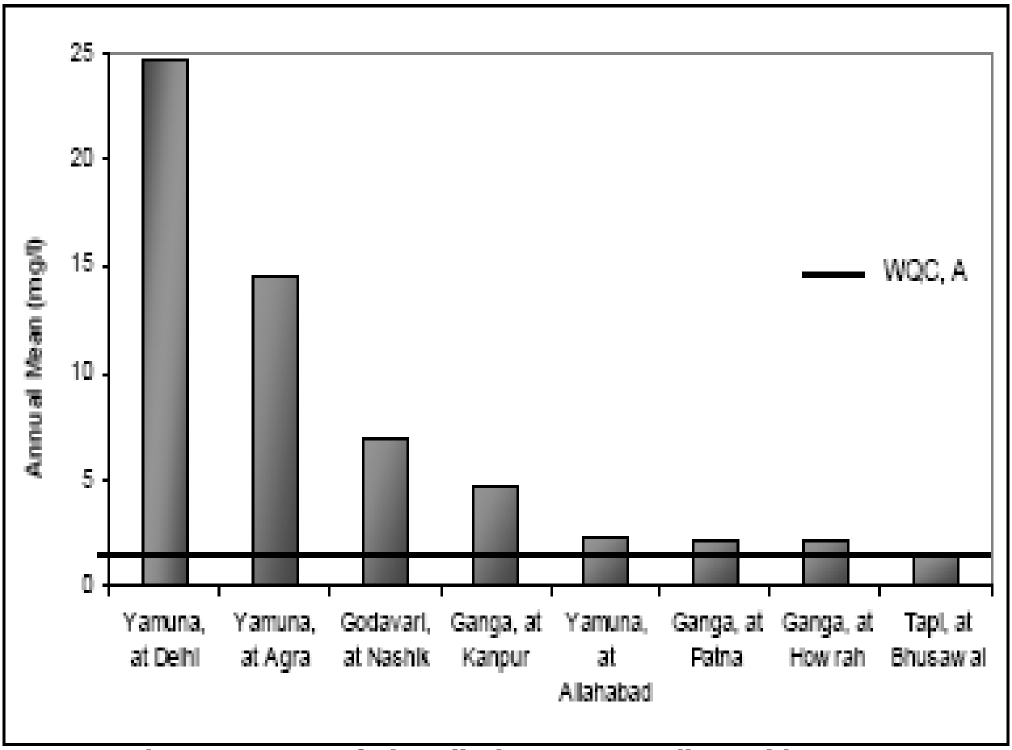

Chart 2: Status of Air Pollution across India – Mid-2000s

World Bank (2005) assessed that the annual economic cost of damage to public health from increased air pollution alone based on RSPM measurements for 50 cities with the total population of 110 million was close to US$ 3 billion in 2004. A significant health burden is also associated with the indoor air pollution resulting from the use of 'dirty' fuels such as firewood. Smith and Mehta (2002) have analysed the years of life lost (YLL) and disability adjusted life years (DALY) among the rural and urban children below the age 5 years and estimated the YLL and DALY attributable to the use of solid fuels in the household in India is annually about 20 million.

Chapter 4

COPING WITH POLLUTION: ROLE OF ENVIRONMENTAL TAXES

There are two major groups of policy instruments for achieving the environmental objectives: regulatory and market based economic instruments[1]. Regulatory instruments prescribe emission standards or effluent limits. These require considerable administrative costs for implementation and monitoring. Their effectiveness also depends on a number of conditions. Market based instruments include taxes, subsidies, and trading instruments. In comparison with the regulatory policies, market based instruments may be able to reduce the costs of achieving a given level of environmental protection through incentives.

The OECD (2007) and the International Energy Agency and the European Commission [see, Ekins (2009)] define environmental taxes as "Any compulsory, unrequited payment to general government levied on tax-bases deemed to be of particular environmental relevance". The tax-bases include energy products, motor vehicles, water, measured or estimated emissions, natural resources etc.

Environmental tax reforms (ETR) constitute an indirect, self-monitoring, incentive-based changes in the tax structure to achieve environmental objectives. These have the potential to induce appropriate environmental decisions through instituting an incentive structure by raising the relative costs of polluting inputs and outputs. ETR is not meant to be a revenue-augmenting device. Instead, the idea is to change the structure of taxation without putting additional burden on the tax payers. ETR reduces the use of resources and pollution by making them more expensive. At the same time it reduces distortionary taxes on labour and capital, making them cheaper, leading to increased output, employment and resource productivity. Similarly, these can be used to reduce the overall GST tax rate (RNR) thereby reducing the deadweight losses associated with indirect taxes

Environmental taxes have the attraction that they insulate polluters from the risk that regulatory requirements might involve in terms of excessive abatement costs. The tax rate per unit of emissions places an upper limit on the unit abatement cost to be

[1] A third alternative is also emerging based on information disclosures. By disclosing the environmental performance of a firm, it is anticipated that the firm would adjust its environmental performance through the market feedback.

incurred. If abatement turns out to be more costly per unit than the tax per unit, firms will simply pollute and pay the tax, rather than paying for costly abatement. By contrast, regulatory policies which set a quantitative limit on emissions may risk requiring that abatement measures are undertaken which are far more costly than the resulting environmental benefits.

Environmental taxes can be advocated from the viewpoint of static and dynamic efficiency gains. Static gains arise through reallocation of abatement among various polluters. As the costs of pollution abatement vary across firms or individuals, environmental taxes have the potential to minimise costs, for two important reasons. First, taxes provide each polluter with incentive to abate in the least-expensive ways and thus achieve a given level of abatement at lower total abatement cost. Second, taxes can avoid the need for the regulatory authority to acquire detailed information on individual sources' abatement costs. This would lower the public sector's costs of regulation.

Dynamic gains arise through providing incentives for innovations. Regulatory policies, stipulating that polluters must use particular technologies, or maintain emissions below a specified limit, do not provide polluters with any encouragement to make reductions in pollution beyond what the regulations require. Environmental taxes provide a continuing incentive for polluters to seek ways to reduce emissions, even below the current cost-effective level. This incentive arises because the tax payment is made on each unit of residual emissions. New technologies may further reduce marginal cost below the tax rate and lead to further abatement. As the demand for green technologies is increasing globally, this can also lead to new comparative advantages, further stimulating employment and output. Flow Chart 3 highlights three channels through which ETR can positively impact growth: (i) lower health management costs, (ii) lower deadweight losses, and (iii) promotion of environmental industries through financing of eco-subsidies.

Studies suggest that energy use and corresponding emissions tend to rise with income, and that increases in energy prices will tend to reduce energy use. ETR tends to increase energy efficiency as well as reduce energy demand. The main challenge that India faces is as to how to reduce the energy-intensity of growth so that potential growth can be achieved at lower levels of energy use and pollution.

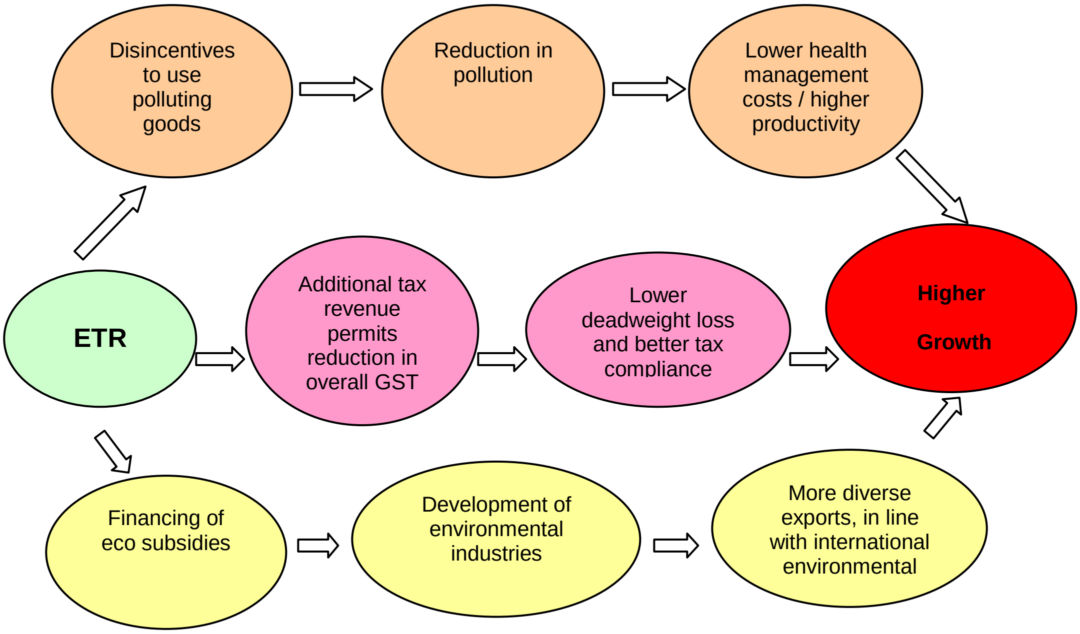

Chart 3: ETR and Growth: Channels of Interface.

Chapter 5

INTERNATIONAL EXPERIENCE WITH ENVIRONMENTAL TAX REFORMS

Internationally, environmental tax reform has become the norm for many countries and many beneficial effects are already visible. 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) mention 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 environmental taxes stems from taxes on motor vehicle fuels and motor vehicles.

The implementation of environmental tax reforms goes back to the early nineties. Sweden, Denmark, Norway, Finland and the Netherlands were the early reformers. Sweden was the first EU country to introduce environmental tax reform where specific charges for carbon dioxide, sulphur dioxide and nitrous oxide were introduced and later the ETR became more complex.

Eco-taxes can serve two purposes: one, stem the flow of additional pollution by discouraging the use of polluting inputs and outputs (disincentive effect), and two, generate additional revenue which can be used partly or fully for providing environmental public goods (revenue effect). An important issue is whether eco-tax revenue should be fully earmarked for environmental public goods. Appendix 2 provides a detailed discussion on environmental public goods and eco-tax revenue by introducing analytical framework involving the concept of *social marginal cost of public funds*. Given the practical difficulties involved in measuring social marginal cost of public funds, certain conventions or rules of thumb may have to be used while assessing the link between eco-tax revenue and environmental public goods. It can be argued that such conventions will need to be different between developed and developing countries. In developing countries, environmental taxes can be used to some extent in increasing the tax-GDP ratio and a higher percentage can be allocated for environmental public goods.

In the developed countries, given high tax-GDP ratio, the revenue from the environmental tax can be used to replace conventional distortionary taxes and to provide general public goods. In practice this was what most developed countries followed. The revenue from the new tax regime was recycled into a reduced level of income tax and employers' contributions in order to benefit both households and industry.

Denmark initially targeted households, by increasing taxes on waste and recycling the revenue through reductions in income tax. Subsequently, in 1996, industry was targeted with energy taxes introduced alongside reductions in social security contributions. Since 1999, the tax burden has been shifted further, by raising environmental and corporate taxes and reducing personal taxes. The Netherlands has recycled increased energy tax revenue into both lower income tax and employers' contributions alongside a 3 percent reduction in corporate tax, greater tax credits for small business and increases in tax free allowances. Reforms in Finland introduced a carbon dioxide tax in addition to other energy taxes, although electricity generation was exempted and gas subjected to a 50 percent reduction. Benefits were skewed towards households despite industry being equally affected by the new taxes. Finland's tax shift, estimated at 1.25 percent of GDP, was quite large.

Germany increased existing energy taxes and introduced a new electricity tax and recycled the revenue by reducing social security contributions. This amounted to a tax shift of almost 1 percent of GDP. The environmental taxes were complemented by special reductions and subsidies for renewable energy, bio-fuels, and combined heat and power (CHP) facilities. Overall the environmental taxes raised revenues in the order of 2-2.5 percent of gross domestic product.

International experience has shown that environmental taxes can be quite effective in their environmental impact. It has been shown that the fuel taxes have had a significant environmental impact. In a recent study, Sterner (2007) reviews several studies for a number of countries and concludes; "Had Europe not followed a policy of high fuel taxation but had low U.S. taxes, then fuel demand would have been twice as large". Sterner observes that fuel taxes are the single most powerful climate policy instrument implemented to date. Environmental tax reform can have a powerful effect on energy use. Ekins (2009) estimates the price elasticity of energy demand in the UK at about (-) 0.64, which implies that a 10 percent increase in the energy price will reduce energy consumption by 6.4 percent. He also finds that energy use tends to increase with value added with an elasticity of (+) 0.5 (meaning that a 10 percent increase in value added will tend to increase energy consumption by 5 percent). Other things being equal, this means that if a sector (or by implication the economy as a whole) is growing, its energy use will be growing too, unless it is restrained by a rising energy price. Table 2 provides a summary of the impact of the 'Green Shift' as evaluated by U.K's Green Fiscal Commission. A more detailed analysis is given in Appendix 3.

Table 2: Impact of a Green Shift in Taxation: Selected International Evidence

Country and Tax	Period Evaluated	Impact	Source
Finland- energy &carbon tax	1990-2005	CO_2 emissions 7 per cent lower than would have otherwise been A shift from carbon tax to output tax on electricity in 1997 may have lessened impact	Nordic council 2006 Nordic Council 1999
Norway-Carbon &sulphur dioxide taxes	1991-2007	21 per cent reduction in CO_2 from power plants by 1995 14 per cent national reduction in CO_2 in 1990's, 2 per cent attributed to carbon tax 12 per cent reduction in CO_2 emissions per unit of GDP	OECD 2001 OECD 2006 Nordic council 2006
Denmark- energy &carbon tax	1992	CO_2 emissions in affected sectors down by 6 per cent and economic growth up by 20 per cent between 1988 and 1997 and a 5 per cent reduction in emission in one year in response to tax increase In 1990s a 23 per cent reduction in CO_2 from as usual trend and energy efficiency increased by 26 per cent Subsidy to renewables may have accounted for greater proportion of emissions reductions than tax	OECD 2006 Nordic Council 2006
Sweden-energy & carbon taxes	1990-2007	Emissions reductions of 0.5 million tons per annum Emissions would have been 20 per cent higher than 1990 levels without tax	Nordic council 2006 Swedish Ministry of Finance 2004
The Netherlands- energy tax	1999-2007	Emissions 3.5 per cent lower than would have otherwise been Low tax rates may have limited impact	Finance ministry, the Netherlands 2007
Germany- environmental tax reform, taxes on transport , fuels & electricity	1999-2005	CO_2 reduced by 15 per cent between 1990 and 1999 and 1 per cent between 1999 and 2005 CO_2 emissions 2-3 per cent lower by 2005 than they would have been without tax German re-unification an important factor in reductions	EEA 2007 OECD 2006
UK-Industrial energy tax	2001-2010	UK CO_2 emissions reduced by 2 per cent in 2002 and 2.25 per cent in 2003 and cumulative savings of 16.5 million tonnes of carbon up to 2005 Reduction in UK energy demand of 2.9 per cent estimated by 2010	Cambridge Econometrics 2005 HMT 2006

Source: Green Fiscal Commission, U.K. (2009).

With a reasonable change in the relative prices of labour and environmental resources, environmental tax reform may significantly change the incentives for innovation and technological development, inducing companies to devote more effort to increasing resource productivity, and less to increasing labour productivity. Industries that reduce pollution, increase resource productivity and encourage a switch to renewable resources. These industries are collectively being called the environment industries (EI) which have two distinct components: the supply of traditional *pollution control* technologies and services ('end-of-pipe treatment') and industries relating to *resource management* (management of materials and energy). Both components of the EI have contributed to environmental improvement in the EU. Some of the main environmental industries may be classified as given in Table 3. India needs to develop capacity in these industries where there is potential of considerable growth of demand rather than concentrating on polluting industries where already there is considerable excess capacity globally.

Table 3: Upcoming Environmental Industries

Pollution Control	Resource Management	Administration. Management, and Research
Waste water treatment	Solid waste management and recycling	General public administration
Air pollution control	Recycled materials	Private environmental management
Remediation/clean-up of soil/ground water	Renewable energy production	Environmental research and development
Noise and vibration control	Water supply	
Environmental monitoring Nature protection	Eco-construction	

Source: Based on Ekins (2009).

Chapter 6

ECO-TAXES AND GST IN INDIA

The system of taxation of goods and services in India has been subjected to extensive reforms since the nineties. As a result, we have moved away from the earlier structure of cascading type of taxes like the central excise duty and the state sales taxes. Even after the levy of Cenvat and Statevat, the Indian tax system is replete with many distortions and inefficiencies. There is continuing cascading between Cenvat, State Vat and Service tax. India is about to embark upon a major tax reform of its system of indirect taxes that will integrate central and state taxes on goods and services resulting into a comprehensive goods and services tax (GST). The issue is as to how to handle environmental tax reform in the framework of GST. As already discussed, many countries that have VAT have also initiated environmental tax reform. We can opt for a suitable design learning from their experience so that we can have environmental taxes well integrated with GST from the very beginning.

At present, the Empowered Committee of State Finance Ministers has been working towards evolving a common structure of GST that will be acceptable to the centre and the states. After extensive discussions, some features of the proposed GST appear to be taking a clear shape. Among various forms of GST, given our fiscal federal arrangements, India is headed towards a concurrent GST. The central and state governments will be entitled to tax the same tax base covering the value added upto retail for goods and services consumed in their jurisdictions. The GST will have two components: central GST (CGST) and state GST (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. The additional excise duties in lieu of sales tax for sugar, tobacco, and textiles will also be integrated with GST.

In regard to the interface between GST and eco-taxes (ET), several features may be noted:

- 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.
- Eco-taxes call for differential rates of tax on polluting inputs and outputs but the accepted GST norm is to go for a uniform rate regime although some countries do have more than one rate.
- In inter-state trade, the destination principle applies and the producing state where pollution may be localized does not get any part of tax revenue. It is only the consuming state that gets the tax revenue whereas the pollution is suffered by the citizens of the producing state. A non-rebatable cess on the GST will provide some tax revenue for the producing state.
- In GST, exports will be zero-rated. The importing country may tax the good but the country where production and pollution may take place does not get any tax revenue. The same argument at a more local level applies to special economic zones (SEZs).
- ET provides additional tax revenue to enable reducing overall GST rate (RNR) than would otherwise be the case thereby reducing the deadweight costs.
- Moving to GST with uniform rates may imply a lowering of the current tax load on polluting inputs and outputs where currently cascading may imply higher tax rates. As such without the incorporation of environmental cesses, the move to GST may be environmentally perverse. Appendix 4 provides information about the effective tax rates on polluting goods in India.
- Introducing ETR into the GST framework requires coordination between the centre and the states and among the states so that another kind of 'race-to-bottom' does not get initiated where industries start to relocate themselves in those states where environmental taxes or regulations are weak.
- Many of the developed countries are imposing restrictions on their imports to ensure that goods imported by them meet environmental norms. The introduction of ETR in GST will incentivise Indian exporters to meet environmental norms and this will support the drive to increase India's exports.
- In moving to a destination based GST, many of the producing states will lose revenue because of the abolition of the central sales tax. Although some compensation is being estimated, this will only be for a few years. With the ETR in place, the producing states will have a longer term mechanism in their hand to generate revenues that can support their activities for dealing with pollution in their jurisdictions.

A 'green shift' in taxation of goods and services 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. It will also improve inter-generational equity by spreading better among different generations the use of natural resources and fossil fuels as compared to their over-exploitation 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.

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. This may happen if some states pursue more actively pollution control while others are more relaxed and the CST also goes.

Chapter 7

ECO-SUBSIDIES AND ECO-TAXES

Eco-taxes should be complemented by eco-subsidies. Eco-subsidies can be given to provide incentives to producers and consumers for favouring goods and services that have environmentally favourable properties. Subsidies decrease the relative price of products and encourage their use. There could be direct subsidies financed by the general budget, as also subsidies linked to eco-taxes where tax revenues are partially or fully earmarked for financing eco-subsidies. Eco-subsidies can also be administered through tax expenditures in the form of tax credits or allowances to encourage expenditure for usage of environmentally friendly inputs and outputs.

Internationally there are several examples of eco-subsidies. In Netherlands a rebate is provided for replacement of old appliances; in Spain, Hungary and Denmark, a direct payment of subsidy is made for replacement of old appliances. In Italy, the consumers receive a tax rebate for the purchase of energy efficient refrigerators and freezers. In France, purchases of condensing boiler are promoted though a tax credit and in Australia there are region specific subsidy schemes. In many EU and non-EU countries purchases of compact fluorescent lamps (CFL) is encouraged through subsidies. In USA corporate tax credits are given to manufacturers of energy efficient appliances or to the owners of commercial buildings for the installation of energy efficient equipment. Many states in the USA provide subsidies and personal income tax credits for energy conservation. In India also, there are some subsidies to incentivise use of production of energy saving devices or alternative sources of energy.

There are several advantages in targeting environmental goals through subsidies. Subsidy schemes can be better targeted to specific consumer groups. In particular, some of the distributional concerns of energy taxation can be addressed through subsidies targeted to lower income groups. Also, direct subsidies can be more calibrated to the product characteristics. Some products need higher subsidies than others.

Chapter 8

IDENTIFICATION OF POLLUTING INPUTS AND OUTPUTS

Pollution can be of different types: air, water, land, toxic and metal pollution. It is important to distinguish between pollution from production (industrial pollution) and that from consumption (pollution from residential and commercial sectors, transport and the use of harmful products like plastics, fertilizers etc.). Further industrial pollution can be traced to the use of polluting inputs and/or the manufacturing process. Process related pollution can be reduced by using better processes. Thus, to reduce industrial pollution either inputs/outputs can be taxed, or facilitate adoption of environment friendly technologies through eco-subsidies, or both. In addition, bulk of the pollution can also be traced to the fuel used.

Since the design of GST should be such that only a limited number of polluting inputs and outputs should be selected for differential rates of taxation or levy of non-rebatable taxes on inputs, the selection of commodities has to be such as to maximize the environmental impact with a limited number of environmental taxes. It should also be dovetailed to regional environmental pollution characteristics.

It should be noted that environmental management needs multiple instruments including the eco-taxes and other economic instruments, command and control regulations, and information disclosure instruments. For effective environmental management, a combination of all these instruments is required. The discussion here with focus on eco-taxes must not be construed upon as nullification of the need for other instruments.

8.1 Industry-wise Heavy Polluters

Appendix 4 identifies major polluting industries in India and their state-wise positions. It also describes the methodology used to derive the relative rankings and pollution loads. It is shown that at the all India level, iron and steel industry is the highest polluting industry in terms of all four pollutants except air where it ranks second to cement. Iron and steel is the largest water polluting industry in India with 87.4 percent of the total pollution load. The pulp and paper and aluminum industries rank second and third respectively with their contribution to total water pollution load at 4.6 and 2.5 percent. Sugar and distillery industries rank fourth and fifth, respectively.

The cement industry is the biggest air polluter emitting nearly 34 percent of the total air pollution load. Iron and steel stands second, emitting 32 percent, while oil refinery ranks third contributing 7.4 percent to the total industrial air pollution load. The iron and steel industry is also the largest metal polluter accounting for more than 71 percent of the total metal pollution load. Aluminum industry is the second highest contributor (nearly 16 percent) to metal pollution. In the toxic pollution category also, iron and steel industry is the highest polluter contributing 39 percent of the total pollution load. The second most polluting industry in this category is leather with about 14 percent share in total toxic load. Iron and steel, leather, petrochemical and oil refinery industries together account for 70 percent of total toxic pollution load. The main implication of these results is that substantial reduction in total pollution loads can be achieved by focusing pollution control efforts in a limited number of industrial sectors.

8.2 State-wise Heavy Polluters

Since, the sources, incidence, and intensity of pollution are different across states, in determining state level interventions these differences should be taken into account. As detailed in Appendix 4, the relevant ranking in each category of pollution are as follows:

Water: Bihar, Maharashtra, Madhya Pradesh, Orissa, West Bengal.
Air: Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh, Bihar
Toxic: Maharashtra, Gujarat, Tamil Nadu, Bihar, Uttar Pradesh
Metal: Bihar, Maharashtra, Orissa, West Bengal, Uttar Pradesh

It may be noted that in determining the extent of intervention population density of the states should be taken into consideration. A high density state (like West Bengal or Kerala) will face higher per capita burden of pollution and the policy needs to take this into account.

8.3 Petroleum and Energy

In designing eco-taxes, considerable importance needs to be attached to taxation of fuel and energy. After a long period of 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. The centre has not been able to follow suitable principles of pricing reflecting the trade parity prices, as recommended by the Rangarajan Committee. Kirit Parikh Committee also made similar observations and suggested market determined pricing strategy for petrol and diesel (see Appendix 5 for details).

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 sales tax 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. In particular, the higher income states, where per capita consumption of petroleum products may be higher, may levy a higher special rate of tax.

Fuel taxes are often criticized on distribution grounds. It is argued that fuel taxes may be regressive, that is, it burdens the poor proportionately more than the rich. Such a contention finds empirical evidence in developed countries. However, it is not the case for developing countries where fuel taxes are generally found to be progressive or neutral. This is attributed to the differences in income and expenditure pattern of households in developed and developing countries.

A study on fuel taxes in South Africa (Ziramba et al.,2009) finds that the distribution of fuel expenditure is progressive and hence suggests that fuel tax would not necessarily be regressive. When indirect use of fuel is included, the effect is still progressive. A similar result is found for China (Cao,2009). He uses micro-level household survey data and elasticity estimates to find out that the fuel tax reform is progressive at all levels, the progressivity being greater in the short run than in the long run. The case of carbon tax was studied for Indonesia using a general equilibrium model which indicates that a carbon tax is progressive in rural household whereas it may be neutral or regressive in urban households depending on the whether the revenues are recycled back or not (Yusuf, 2008).

Datta (2008) studies the distributional impact of fuels in the Indian context. His results indicate progressivity of transport fuel tax in both rural and urban sectors and a neutral effect of coal tax. However, tax on cooking fuels like kerosene imposes a greater burden on the poor and hence is regressive.

For an environmental tax to be effective, the fuel should have both an elastic demand and a high emission potential. The emission potential of transport fuels is around 2.3 kilograms of carbon dioxide per litre of fuel. Different studies report different values for transport fuel elasticity which are price sensitive in the long run ranging from - 0.84 to - 0.42 (Datta, 2008). Hence, transport fuels are a good case for fuel tax as they are progressive and also effective in reducing emissions as they satisfy the above two conditions.

Kerosene is primarily used by poorer households as coking and lighting fuel. Though kerosene has a highly elastic demand especially in the rural areas, it is not advisable to tax kerosene as it is found to be highly regressive. Besides being regressive, a tax on kerosene will also lead to switching to fuel wood which causes extensive indoor air pollution.

It should be noted that progressivity is not the same as equity. Progressivity implies that the rich pay proportionately more tax than the poor. This does not exclude the poor from paying the tax which can leave them with a lower budget to meet other expenditure. Thereby, the income distribution tends to become less equal. The effect of such equity patterns has not been studied widely. Such a negative impact of fuel taxes on equity could have serious implications for India especially since it is an energy poor country. This, however, can be addressed through a program of targeted energy subsidies for the poor.

There is a case to tax electricity on account of the fact that the green house gas emissions from thermal power plants are the highest. An electricity duty is currently being levied by the state governments. Under the GST regime, the effective rate of electricity duty could actually be higher than the current rate. This being the case, there is no need for an additional eco cess to be levied on electricity. However, in states where the effective rate of electricity duty under the GST regime is lower than the current rate, and/or the national average, eco-cess could be levied.

8.4 Tax Treatment of Coal

Coal containing high ash content causes serious environmental pollution and health hazards in transportation and handling, industrial applications, and generation of power. As discussed in section II, coal is the major source of $CO2$ emission in India. Strong incentives are needed to promote coal cleaning and carbon capture technologies. Some initiatives have been taken in this regard. 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" has been 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.

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.

Based on the above discussion and the recommendations of the earlier eco-tax studies, the following could be taken for special consideration of eco-tax and eco-subsidies under the GST regime (see Appendix 6 for details). It should be noted here that the scope of this *Discussion Paper* is to provide policy directions for the implementation of eco-taxes, and not to give specific recommendations about the tax-structure and tax-rate.

a. Coal*:* In addition to the environmentally rational cess on coal (consistent with ash content), the producing states like Bihar, Assam, Orissa, Jharkhand, Madhya Pradesh and Chattisgarh could be allowed to levy a higher cess than the floor rate to facilitate clean-up of production related pollution.

b. Petroleum Products*:* Even though the petroleum products are currently kept outside the GST, given the considerable revenue-importance of tax on these products, they should be eventually brought under GST and additional cess should be levied based on environmental considerations.

c. Chemical Fertilizers*:* Given the adverse environmental effects caused by the non-point source pollution generated through the use of chemical fertilizers, the existing subsidy on these fertilizers should be eliminated in phases. Subsidy should instead be given to the bio-fertilizers.

d. Chemical Pesticides*:* Similar to chemical fertilizers, indiscriminate use of pesticides, particularly in case of commercial crops like cotton, fruits and vegetables, results in significant environmental health damages. Combination of eco-taxes and eco-subsidies should be used to disincentivize and incentivize the use of chemical and bio pesticides *respectively.*

e. Plastics*:* Local level eco-taxes (along with other incentive programs) should be used for reducing demand for plastics by the consumers, promote biodegradable plastics, and incentivize recycling.

Chapter 9

DESIGNING ECO-TAXES AND GST: THE WAY FORWARD

In designing an environmentally oriented GST regime four issues need to be addressed: (a) rate structure and extent of tax load for polluting goods, (b) required constitutional changes and (c) other complementary taxes at state and local level. It may be noted that under current constitutional provisions taxation of pollution (emission/effluent) may not be possible because this externality may not be defined as a good or as a service and also not marketed. It may be further noted that since the suggested eco-taxes will be levied along with the GST, the incremental collection costs are near zero.

In a concurrent GST regime, at present as far as goods are concerned two rates are being talked about: a core rate (RNR) and a lower rate, apart from an exempted category of goods. ETR will call for placing environmental friendly outputs into the lower rate category or exempted category. The issue of higher rate for polluting goods and the as a result the overall reduction in the core GST rate can be decided together. The revenue from polluting goods has ranged in the EU countries between 8 to 10 percent of total tax revenues. Given the revenue importance of indirect taxes in India, revenue recycling from the higher rate of polluting goods could contribute about 20 percent of the overall GST revenue. This means that the core GST rate (RNR) can be reduced by 20 percent compared to a situation where there is no provision for the taxation at higher rate for the polluting goods. Thus, if otherwise the core GST rate is set at say 18 percent, with ETR, it can be set at nearly 3 to 4 percentage points lower.

The taxation of petroleum and electricity in this matter will be crucial. At present, the taxation of petroleum products is being kept outside the purview of the GST[1]. This is one option where the centre and the states will have the freedom to determine their own rates. Alternatively, the petroleum products can be brought into GST with the centre and states retaining the power to levy a non-rebateble cess on top of the core GST rate.

One issue is to determine the rates of the environmental cesses that is the extra tax load on the polluting goods. There are two approaches to this issue: theoretically the ideal rate is determined by the externality involved. In the second approach, this

[1] As per the First Discussion Paper on Goods and Services Tax by the Empowered Committee of State Finance Ministers, released on November 10, 2009.

determination is linked to targets of reduction in pollution. In this case the rate is determined taking into account the price-elasticity of demand and the relevant target. This is the approach being recommended in most of the EU policies where targets of CO_2 reduction have been defined by the concerned legislations. The difficulty with the first approach is that it is difficult to measure with adequate precision the extent of externality that needs to be corrected. In the second case also, in most cases the commitment to reduce the extent of pollution has not been defined in quantitative terms. The central government and the state governments will need to determine the pace of reduction in pollution that can be attempted and these could be inter-state variation in the choice of polluting goods and the increment in tax rate on account of pollution may be in the form of cess which is related to the extent of pollution.

In this paper, the ***GST framework*** is considered to include all domestic indirect taxes that are being included in the proposed GST under discussion as well as those indirect taxes that are being kept outside of GST but that are potentially includable in GST (e.g., central excise duty and state sales tax on petroleum products, state excise duties), and those tax bases that are currently not being taxed but are potentially taxable in a comprehensive GST (e.g, rail transport, post-office services). As such the taxation of petroleum products which will continue to cause cascading in the proposed GST is part of the design of the GST framework. It is being kept out of the GST presently for revenue purposes but could serve environmental objectives also.

Looking at the size of the green shift in achieved in some other countries and the magnitude of the pollution problem in India, as a broad benchmark, we can consider about 2 percent of GDP as the needed shift in India's tax structure. Given that the direct tax rates are not very high and in any case a new direct tax code is being proposed for the direct taxes, most of the green shift could be brought through indirect taxes in the GST framework.

9.1 Required Constitutional Changes

The constitution of India lays down a clear division of powers between the Centre and the States, including the power to levy taxes. There is a clear recognition of the need for harmonization of the Centre and State Taxes. Fiscal autonomy is important to allow the Centre and the States to set the tax rates according to their revenue needs. At the same time, harmonization of tax laws and administrative procedures is needed to simplify compliance and enforcement. It is also necessary to ensure that inter-state differences in policies and procedures do not generate additional economic distortions. For polluting inputs and outputs, both the central and state governments should retain the power to levy a non-rebatable cess or surcharge. Both the centre and the state should have autonomy to determine the relevant polluting goods where the cess should be levied. Depending on the selected form of the GST, there will be a need to bring about constitutional changes so that both the centre and the states are ensured of their relative powers and the arrangements are stable. If the Empowered Committee option of dual GST is adopted, centre will have to be given powers to tax the value added up to the retail stage in the case of goods instead of only up to manufacturing and the states will need to have power to tax all services.

In the context of the ongoing discussion on the proposed GST related constitutional amendments to articles 246, 249, 268, 271, 279, 287, and the Seventh Schedule the following assume significance from the environment perspective:

- The proposed amendments to Article 246 and 249 provide overriding powers to the Parliament in the GST matters through the instrumentality of the Council of States (also referred as GST Council). Giving supremacy to GST Council over the state legislatures in GST matters could in principle reduce the autonomy of States.
- The proposed amendment to Article 271 allowing the Parliament to levy additional surcharges for the purposes of the Union asymmetrically favors the Central Government over the State Governments. The power to levy surcharge is a general power. This should be available to both tiers of government. In the event of treating the levy and collection of cesses on basis of compelling social needs and national contingencies, the interest and share of the States should also be considered.
- The proposed amendments to Article 279A and 279B refer to creation of GST Council and GST Dispute Settlement Authority, respectively. In order to maintain revenue autonomy of both the Centre and the States, it would be appropriate to create these bodies in advisory capacity only. Further, such bodies should mention only 'floor rates' or 'rate-bands' and leave the flexibility to the States to fix the rates higher than the floor rate, should their specific circumstances so warrant. This has also been the practice in other countries as mentioned in Section V.
- The proposed amendment to Article 287 to remove the exemption for electricity consumption by the Government of India and the railways is a welcome change from the environmental perspective.
- In the context of Articles 268 and 269, destination based principle should be the guiding principle in the apportionment of the IGST and this principle should be mentioned as the guiding principle in the constitution itself to safeguard the interests of the states.

The carbon emissions need special attention given the scope for catastrophic impacts due to climate change caused by such emissions. Since carbon emissions are closely intertwined with the economic growth, provisions should be made to bring about carbon tax through the residual powers given to the Centre in Article 248. Under the existing constitutional provisions, it may not be feasible to levy a carbon tax as it cannot be interpreted as 'supply' or 'sale' or 'manufacture' for consideration. Carbon emissions do not have a market and they are only externalities. But such a tax can be levied by the Central Government under its residuary powers without constitutional amendment. Such move is essential to put the economy on low-carbon high-growth path.

9.2 Complementary ETR in State and Local Level Eco-taxes

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 impacts of old vehicles vis-à-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.

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.

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 software's 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 (see Appendix 3 for details). 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.

The construction of ‘Green’ buildings may be encouraged by property tax concession. 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.

Chapter 10

CONCLUSIONS

Pollution in India is high relative to prescribed standards. It has serious implications for sustainability of growth due to depletion of natural resources, implications of climate change, and health hazards. Of the two approaches to pollution control, namely regulatory approach and use of market based instruments, the latter has certain advantages. The two approaches are not mutually exclusive and can be used to complement each other. The main economic instruments are eco-taxes and eco-subsidies. Internationally, there has been a noticeable move towards environmental tax reforms of the existing tax structures thereby giving rise to green shift in taxation.

India is likely to introduce a major change in its system of indirect taxation by bringing in a comprehensive goods and services tax. This paper has argued that this is the appropriate time to introduce a GST that is well integrated with environmental tax reform. This will facilitate the introduction of GST itself by reducing the overall GST rate while allowing for state level variation in the eco-tax component of GST in the form of non-rebatable cesses that allow for state level flexibility. The eco-taxes should be accompanied by eco-subsidies so as to encourage the development of environmental industries by providing incentives for non-polluting processes and goods.

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Technical Appendices

Appendix 1

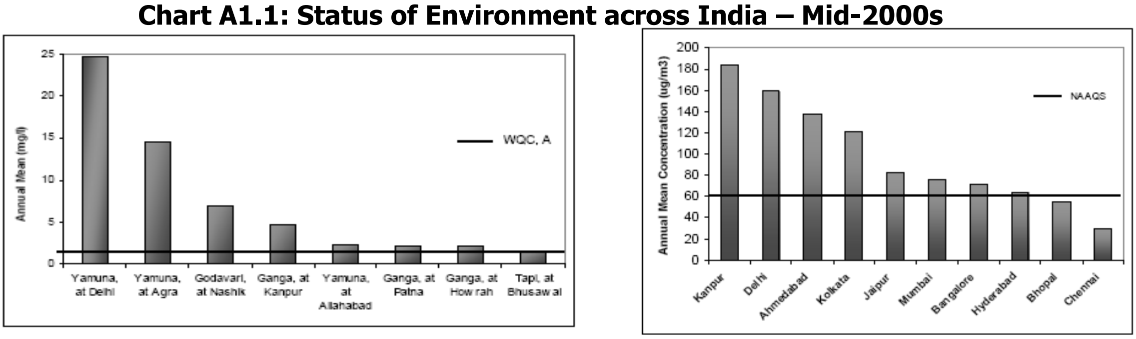
SOURCES, INCIDENCE AND EFFECTS OF POLLUTION IN INDIA

1.1 Extent of Pollution in India

India is at cross roads in terms of sustainable development. On one hand it has registered impressive economic growth along with significant progress in human development in recent years. The country is endowed with rich biodiversity that is protected and conserved through a network of national parks, wildlife sanctuaries and biosphere reserves. On the other hand the country is witnessing high level of urbanization bringing with it plethora of associated environmental problems. High level of industrialization has also brought to the forefront the pollution concerns. A long coast line with dense population will always put the region in vulnerable position with respect to the natural hazards and the recent Tsunami havoc highlighted the same. Thus, natural and anthropogenic factors are putting the environment of India into a precarious position threatening the sustainable development goals.

It is well established through the statistics of CPCB and other agencies that the environmental pollution – water, air as well as solid waste – has been in excess of the national ambient standards. For instance, the water pollution levels measured in terms of biochemical oxygen demand (BOD) in several rivers has been observed to be well above the water quality criteria. Similarly the respirable suspended particulate matter (RSPM) – the main air pollutant from public health point of view – has been well above the national ambient air quality standard in several monitoring stations. Chart A1.1 gives a snapshot picture of the status of the environmental pollution (left panel shows water pollution; and the right panel shows the air pollution) across various monitoring sites/stations in India in mid-2000s.

Chart A1.1: Status of Environment across India – Mid-2000s



Source: World Bank (2007).

In addition to this overall picture, deteriorating conditions of certain hot-spot areas further highlight the need for urgent policy intervention. The Blacksmith Institute of New York started a new initiative to identify the worst polluted places of the world in 2006. In the years 2006 and 2007 the top ten worst polluted places are selected on the basis of size of affected population, severity of the toxin involved, impact on children's health and development, evidence of a clear pathway of contamination, and existing and reliable evidence of health impact.

- In the 2006 report, Ranipet in Tamil Nadu featured among the top ten worst polluted places (Blacksmith Institute, 2006). While the state government has ordered closure of Tamil Nadu Chromates and Chemicals Limited a decade ago, the legacy of the same still continues with no solution still in sight for the safe disposal of 1,500,000 tons of solid waste generated by the factory over two decades before its closure. Blacksmith Institute and Asian Development Bank estimate 3.5 million people as potentially affected people due to ground and surface water contamination. Within five ilometre distance around 68 tanneries operate in Dindigul leading to severe ground water pollution. Tannery effluents reported to have left only 16 out of 56 wells in Kamatchipuram village uncontaminated forcing people to walk long distances for water. The water and soil pollution from the tannery effluents has the potential to affect about 450,000 people.
- In the 2007 report, Sukinda valley in Orissa featured among the top ten worst polluted place (Blacksmith Institute, 2007). Sukinda valley contains about 97 percent of India's chromite ore deposits and is one of the world's largest open cast chromite ore mines. With over twelve mines still in operation, a large quantity of waste rock is spread over the surrounding areas and the Brahmani riverbank. As untreated water is discharged by the mines into the river and onto the soil, more than sixty percent of the drinking water is reported to contain hexavalent chromium at levels that are far above the national and international standards. Of the 26,00,000 potentially affected population in the area, a local NGO has estimated that about 25 percent are affected by various pollution induced diseases.
- Besides these, the 2006 and 2007 reports also highlight other pollution hotspots of India including Kanpur (chemical pollutants from the tanneries), Ankleshwar (heavy metals and chemicals from the chemical units), Vapi (chemicals and heavy metals from the chemical units), Kolkata (lead pollution from lead factories

producing lead ingots and lead alloys), and Mahad Industrial Estate in Karnataka (heavy metals and organic pollutants from the chemical units).

a. Sources of Air Pollution

Among various sources of air pollution, the power and transport sectors are prominent. Thermal power plants based on coal consume about 80 percent of the country's coal production and contribute about 62 percent of the total power generation in the country. Table A1.1 shows region-wise contribution of carbon dioxide emissions over the period 2000-01 to 2006-07. In total emissions there has been an increase of about 30 percent over the period. In terms of regional contribution, western region continues to dominate over others. It is followed by North, South and East.

Table A1.1: Regional Contribution of CO_2 Emissions from Power Sector

(percent)

Region	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	25.60	25.68	24.87	24.99	24.29	25.51	26.14
East	15.18	15.35	15.50	17.15	18.17	19.65	18.84
South	23.28	23.04	24.50	24.56	22.86	21.61	22.05
West	35.36	35.39	34.59	32.74	34.15	32.69	31.83
North East	0.58	0.54	0.53	0.56	0.53	0.54	0.53
India (Million tons)	382.31	400.11	429.48	440.22	462.02	470.85	495.54

Source: Compendium of Environmental Statistics (2007).

In a recent study, Ramachandra and Shwetmala (2009) have estimated the pollution load from various transport sub-sectors for the year 2003-04. Table A1.2 shows the emissions of CO_2, CO, NOx, CH_4, SO_2, PM, HC, N_2O, and NMVOC for the year 2003-04 in gigatons and the relative contribution of different sub-sectors of the transport sector. As could be seen from the table, barring CO, in all other pollutants, the contribution of road sector dominates over all other sub-sectors of transport. The state-wise distribution of emissions of HC and PM from road transport are shown in Chart A1.2. Bulk of the contribution comes from the western states of Maharashtra, Gujarat and the southern states.

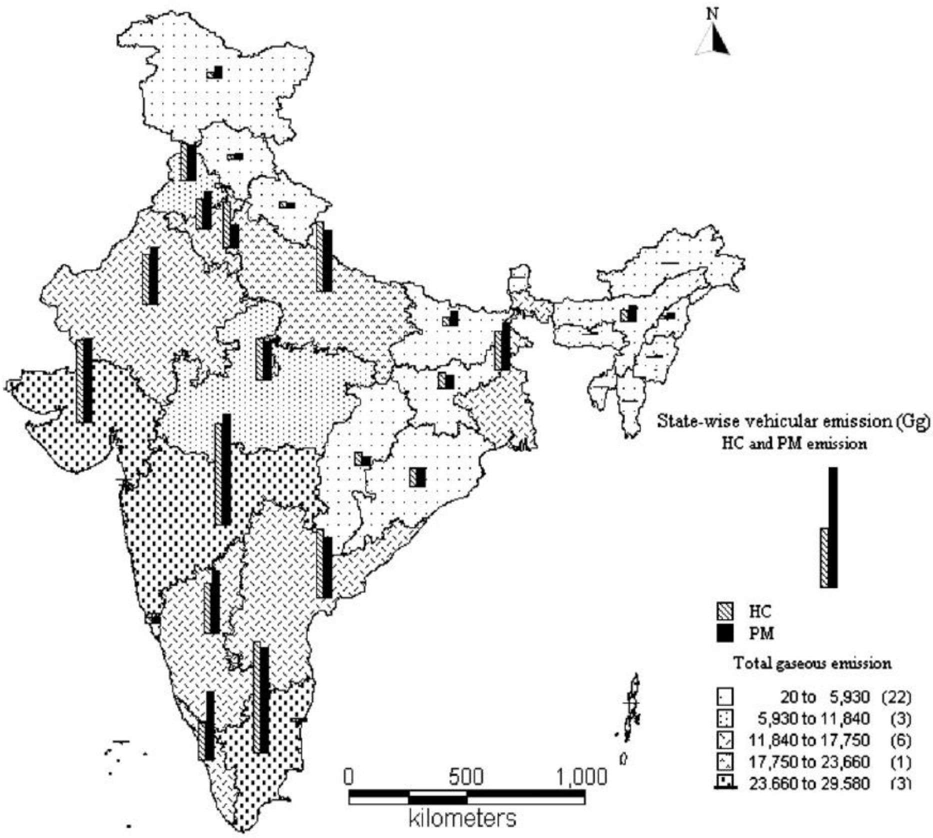
Table A1.2: Pollution Load from Transport Sector in India – 2003-04

(percent)

Details	CO_2	CO	NO_x	CH_4	SO_2	PM	HC	N_2O	NMVOC
Shipping	0.56	0.34	0.68	0.07	0.00	0.00	0.00	20.42	20.53
Railways	2.02	1.25	2.47	0.27	0.01	0.00	0.00	75.18	75.13
Aviation	2.95	45.14	0.52	4.91	0.00	0.00	0.00	4.40	4.35
Road	94.46	53.27	96.33	94.75	99.99	100.00	100.00	0.00	0.00
Total (in Gigatons)	258103	5692	2298	134	729	153	723	0.06	19

Source: Ramachandra and Shwetmala (2009).

Chart A1.2: State-wise Distribution of Emissions from Road Transport – 2003-04

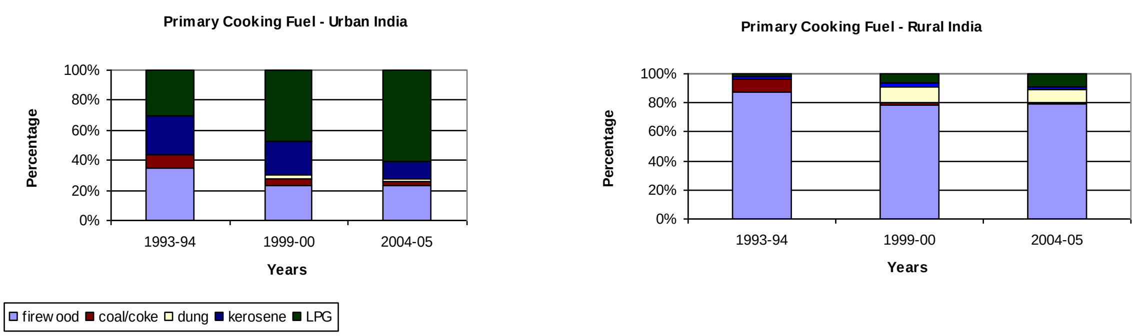


Source: Ramachandra and Shwetmala (2009).

b. Sources of Indoor Air Pollution

Over the past one decade the composition of energy-mix showed very little variation in rural India. The evidence from NSS data shows that use of solid fuels (including, firewood, coal/coke, and dung cake) has slightly decreased from 1993-94 to 2004-05 with the percentage of household using such fuels as primary energy source for cooking declining from 95 to 85 percent. The urban India, on the other hand, registered significant change over the same period, with percentage of households using solid fuels declining from 40 in 1993-94 to 26 in 2004-05. One of the major differences between rural and urban Indian households is in terms of their use of kerosene as cooking fuel. Compared to almost negligible use of this fuel in rural India, kerosene played the crucial role as the transition fuel in the urban India. Of course, LPG penetration has been impressive in the urban India. Chart A1.3 shows the composition of various fuels used as primary cooking fuels by the rural and urban Indian households over the past one decade.

Chart A1.3: Primary Source of Energy for Cooking in India: 1993-94 to 2004-05



There are significant regional differences in India in terms of the consumption of solid fuels. Charts A1.4 and A1.5 show the percentage of households using solid fuels (including firewood, coal/coke, dung cake etc.), kerosene and LPG as primary source for cooking in different regions for three years in the past ten years for rural and urban India, respectively. In rural India, barring the Eastern Indian states, the rest of the states showed some penetration of LPG with about 10 to 12 percent of households reporting this fuel as primary source for cooking in the year 2004-05. With the exception of the Western Indian states, all states showed very little consumption of kerosene for cooking.

In urban India, penetration of LPG has been very impressive with all the regions having more than 50 percent of the households consuming LPG as primary cooking fuel in the year 2004-05. Further, in all the regions, kerosene served as transition fuel. In terms of the solid fuels, the Southern and the Eastern states have showed similar pattern of consumption over the years, whereas the Western and the Northern states exhibited comparable consumption pattern of these fuels in the last decade.

Chart A1.4: Distribution of Cooking Fuels across Regions and Years – Rural India

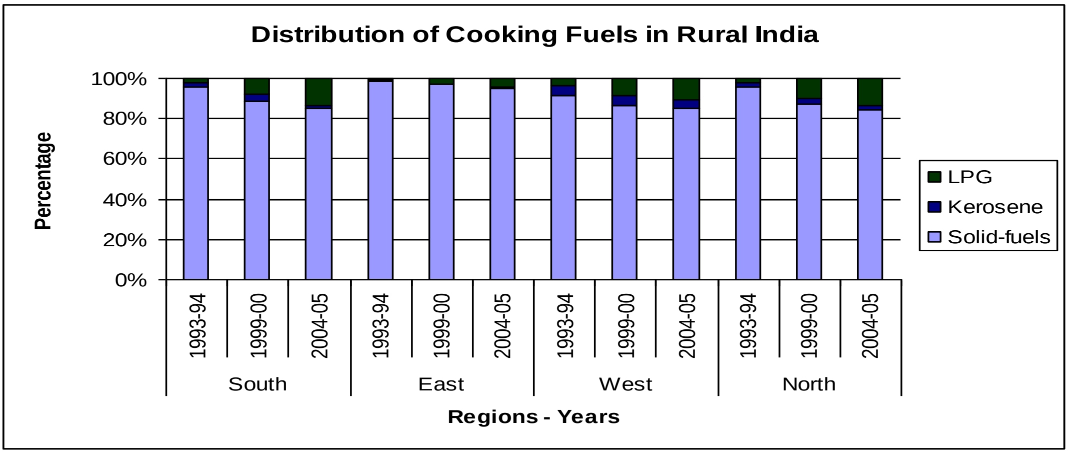
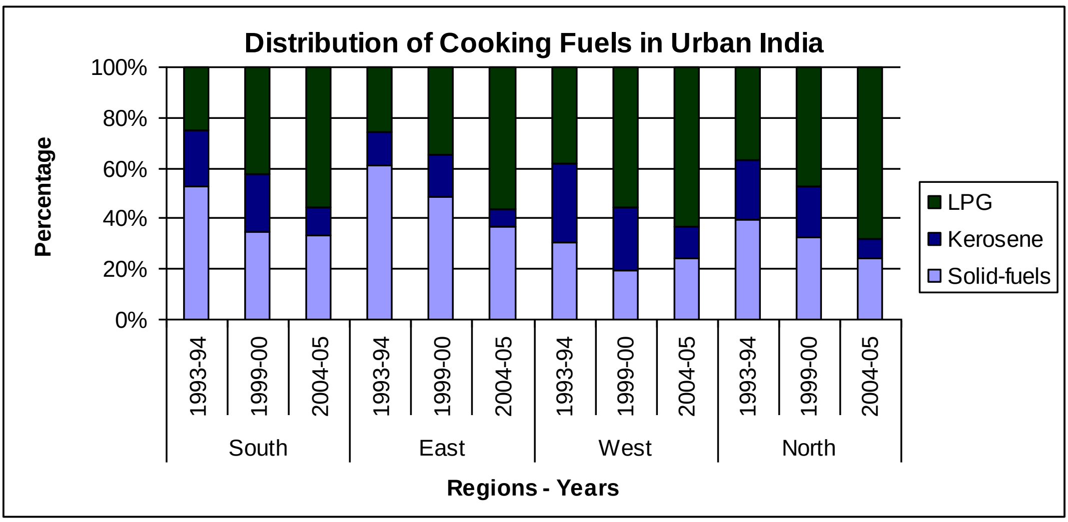


Chart A1.5: Distribution of Cooking Fuels across Regions and Years – Urban India



c. Sources of Water and Land Pollution

Use of pesticides is one of the main reasons for land and water pollution. Table A1.3 provides an inter-state comparison of pesticide consumption over the period 2000-01 to 2007-08. Uttar Pradesh, Punjab, Haryana, West Bengal, Rajasthan, and Maharashtra have maintained high consumption of pesticides throughout the period. On the other hand, states like Andhra Pradesh have registered sharp fall in the pesticide consumption. Tamil Nadu has increased its pesticide consumption significantly during the same period. Bihar, Madhya Pradesh, Assam and Kerala have remained low in their pesticide consumption through out the period. At the all-India level, the pesticide consumption has witnessed a marginal growth of about 0.1 percent during the past eight years.

Table A1.3: State-wise Consumption of Pesticides: 2000-01 to 2007-08

(in Million Tones)

State	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Assam	245	237	181	175	170	165	165	158
Bihar	853	890	1010	860	850	875	890	870
Gujarat	2822	4100	4500	4000	2900	2700	2670	2660
Haryana	5025	5020	5012	4730	4520	4560	4600	4391
Karnataka	2020	2500	2700	1692	2200	1638	1362	1588
Kerala	754	1345	902	326	360	571	545	880
Madhya Pradesh	871	714	1026	662	749	787	957	696
Maharashtra	3239	3135	3725	3385	3030	3198	3193	3050
Orissa	1006	1018	1134	682	692	963	778	NA
Punjab	7005	7200	7200	6780	6900	5610	5975	6080
Rajasthan	3040	4628	3200	2303	1628	1008	3567	3804
Tamil Nadu	1668	1576	3346	1434	2466	2211	2048	3940
Uttar Pradesh	7023	6951	6775	6710	6855	6672	7414	7332
West Bengal	3250	3180	3000	3900	4000	4250	3830	3945
All-India	**43584**	**47020**	**48350**	**41020**	**40672**	**39773**	**41515**	**43630**

Source: Indiastat.

While much attention has been paid in the past to the air and water pollution, more and more evidence is emerging regarding the solid waste problems in India. In particular the municipal solid waste management is posing significant burden to the local governments. It is estimated that about 35 to 45 million tons of municipal solid waste is generated annually, with urban centers contributing to more than 80 percent of the total waste generated. The average waste generated per capita is estimated as 300 to 500 grams per day in 2000. With the urban population poised to grow by about 40 percent in the next 10 years, the municipal solid waste is bound to acquire primary importance in India.

1.2 Costs and Impacts Due to Pollution

World Bank (1995) for the first time provided an aggregate economy-wide estimate of cost due to various environmental pollution in India. The study estimated the health impact of water pollution to be $5,710 million and the agricultural output loss due to soil degradation as $1,942 million. The health impacts of air pollution were assessed as $1,310 million and the loss of live stock carrying capacity due to rangeland degradation was found to be $328 million. The cost of deforestation came to $214million and the loss of international tourism was found to be $213 million. Overall, the results show that the total environmental damage was $9.7 billion per year, or 4.5 percent of GDP in 1992 values.

In a subsequent estimate World Bank (2005) assessed that the annual economic cost of damage to public health from increased air pollution alone based on RSPM measurements for 50 cities with the total population of 110 million was close to US$ 3 billion in 2004.

Solid fuels burned in traditional stoves often result in inefficient combustion, with less than 80-90 percent conversion of fuel carbon into carbon dioxide (CO_2). The products of incomplete combustion – such as, carbon monoxide, formaldehyde, benzene and many other pollutants that have potential to cause health hazards – get emitted through small particles in many houses using the solid fuels.

Given that most houses have inadequate ventilation for kitchens, and living rooms are not separated from kitchen areas, the emissions from use of solid fuels are inhaled routinely by the members of the household. Particularly the women, children and elderly in the house get maximum exposure from these emissions.

Several studies have now conclusively established the relationship between the exposure to the indoor pollution and significant health risks. It must be noted that, since exact measurement of indoor pollution and the associated exposure is often difficult, most studies have linked use of solid fuels with the health burden observed. Despite the inaccuracies, the evidence on health burden appears to be robust (Ezzati, 2004). Smith *et al* (2004) observed that most common health problems associated with exposure to indoor air pollution include (a) acute lower respiratory infections (pneumonia) in children, (b) chronic obstructive pulmonary disease, and (c) to lesser extent, lung cancer. Health risks associated with indoor air pollution now considered as one of top ten risk factors in the world – with countries like India and China experiencing the maximum impact due to such risks. Balakrishnan *et al* (2004) in a recent study of indoor air pollution associated with use of solid fuels for cooking in Andhra Pradesh established that use of solid fuels for cooking exposes the members of the family on a daily basis to air pollution that is more than the standards prescribed for outdoor air pollution. Further the study established conclusively that even when the cooking is done outside the house (or in a separate kitchen), when the solid fuels are used for cooking the resultant levels of RSPM and the household members' exposure to the same exceeds significantly the prescribed standards for the ambient air.

Another, relatively less discussed aspect of solid fuel usage is their contribution to the global warming. The bio fuels, which constitute bulk of the solid fuels in India, are typically considered as 'carbon neutral' – i.e., the carbon released into the atmosphere through burning of these fuels is recaptured during the growth of the biomass. However, the incomplete combustion of biomass fuels releases what are known as 'black carbon' particles, which is a significantly stronger greenhouse gas pollutant than CO_2. Venkataraman *et al* (2005) showed that use of wood and other biofuels in South Asia has resulted in release of black carbon to the tune of 172 Gg/year in the year 1995 and almost similar amount (160 Gg/year) a decade earlier. This study also established that these emissions contributed significantly to atmospheric concentration of greenhouse gases from the region.

Thus, enabling the household to shift from solid fuels to 'cleaner' fuels (such as LPG) for cooking results in not only reducing the health burden but also the global warming burden. Further, climate change mitigation policies in this region should include measures to reduce dependence of households on solid fuels for cooking.

Smith and Mehta (2002) have analysed the years of life lost (YLL) and disability adjusted life years (DALY) among the rural and urban children below the age 5 years and estimated the YLL and DALY attributable to the use of solid fuels in the household. Table A1.4 summarizes their findings and shows that annually about 20 million YLL and DALY in India can be attributed to not using the clean fuels.

Table A1.4: Estimated Annual Child Mortality Due to Use of 'Dirty' Fuels in India

Ages	Urban	Rural	All India	YLL (Million)	DALY (Million)
7 days to < 1 year	10000	385000	395000	13.2	13.6
1 year to < 5 years	4000	172000	176000	6.2	6.4
Total	**14000**	**557000**	**571000**	**19.4**	**20**

Source: Smith and Mehta (2002).

a. Impact of Natural Resource Degradation – GIST (2008)

Recently Green Indian States Trust (GIST) has made an attempt to estimate the aggregate impact of natural resource degradation on Indian economy. The resources covered included depletion of forest resources, biodiversity loss, agricultural and pasture land degradation, and loss in ecological services. The gain/loss due to change of these resources are estimated across major states of India and expressed with reference to the NSDP in 2002-2003. Table A1.5 provides a summary of these estimates.

- In terms of loss due to depletion of timber, fuelwood, and non-timber forest products, Bihar is estimated to have incurred significant burden – about 5 percent of its NSDP, followed by Himachal Pradesh (2 percent of its NDSP) and Orissa (1 percent of its NDSP). At all India level, the losses are estimated at about 0.5 percent of NDP.

- With regard to loss due to depletion and degradation of agricultural and pasture land Rajasthan, Madhya Pradesh and Orissa registered high losses (4 percent, 3.5 percent and 3 percent respectively of NSDP).

- Himachal Pradesh, Uttar Pradesh and Kerala registered significant loss due to biodiversity loss from the forest degradation. However, in terms of ecological services such as water augmentation, soil erosion control, and flood prevention several states reported gains.

Table A1.5: Impact due to Natural Resource Degradation: Indian States

State	NSDP: 2002-2003	Value of Depletion of Timber, Fuelwood etc.	Value of Depletion and Degradation of Agricultural and Pasture Land	Gain/Loss in Biodiversity Values of Forests	Gain/Loss in Value of Ecological Services – Water Augmentation, Soil Erosion Control, Flood Prevention
AP	1439753.9	-8094.07	-17720.62	-2337.66	10071.06
Assam	317208.0	-747.18	-4980.48	-26931.99	21624.05
Bihar	787033.6	-37809.55	-12054.12	-780.18	3286.895
Gujarat	1144047.6	-4343.23	-17359.93	-5596.51	17045.59
Haryana	579374.9	-2187.86	-5934.15	-5378.50	4024.24
HP	142024.3	-2809.31	-1135.38	-6258.40	10470.24
J& K	128052.0	1007.57	-1390.85	-6190.07	8748.96
Karnataka	1004063.1	698.00	-18679.81	-14196.56	25840.59
Kerala	696021.2	-1943.65	-3839.54	-14965.45	17220.35
MP	974607.6	3756.57	-34681.28	-4095.19	10626.55
Maharashtra	2632252.5	-3732.03	-32060.84	-1814.43	17735.75
Orissa	387373.0	570.51	-11250.77	187.66	-1359.26
Punjab	629677.5	-5700.36	-6914.53	-8293.21	5306.49
Rajasthan	768878.0	-4956.45	-31032.37	-5017.57	12522.31
TN	1367808.7	-7602.77	-10278.82	-2890.12	3466.63
UP	1568624.7	-606.74	-28970.25	-34657.28	28002.37
WB	1537807.2	-12015.19	-9490.35	-2107.95	2143.66
India	**16387845.8**	**-72549.05**	**-258604.87**	**-69258.71**	**190402.80**

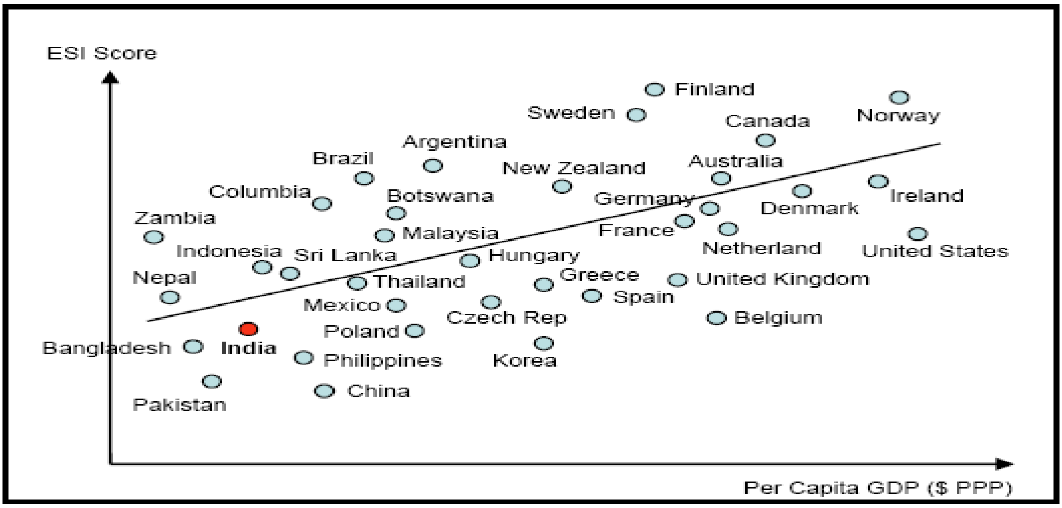
Source: http://www.gistindia.org/publications.asp.

1.3 Economic Growth and Environmental Pollution

How to take stock of the environment of a region, so that 'effective' actions could be initiated? As the above section illustrates the anthropogenic activities causing the environmental degradation are legitimate economic activities, and their impacts can only be ascertained after a time lag. Moreover the fact that the environmental goods are non-marketed in nature makes the valuation extremely difficult. The 'effective' interventions should ideally be chosen by appropriately weighing the costs of intervention with the benefits of avoided environmental degradation. Given the large gestation periods associated with such detailed analysis, studies aimed at providing policy insights often adopt indicator based approach to identify the 'hot spot' areas within a region.

Environmental Sustainability Index (ESI) is one of the most comprehensive measures of a country's environmental performance. A cross-country analysis of ESI and per-capita gross domestic product (PPP) reveals a strong positive relationship as shown in Chart A1.6. The line depicts expected ESI score at each level of income and is estimated through statistical regression. While India's score is better than some of its neighbors including Pakistan and China, its environmental performance is lower than expected (revealed by its position below the regression line).

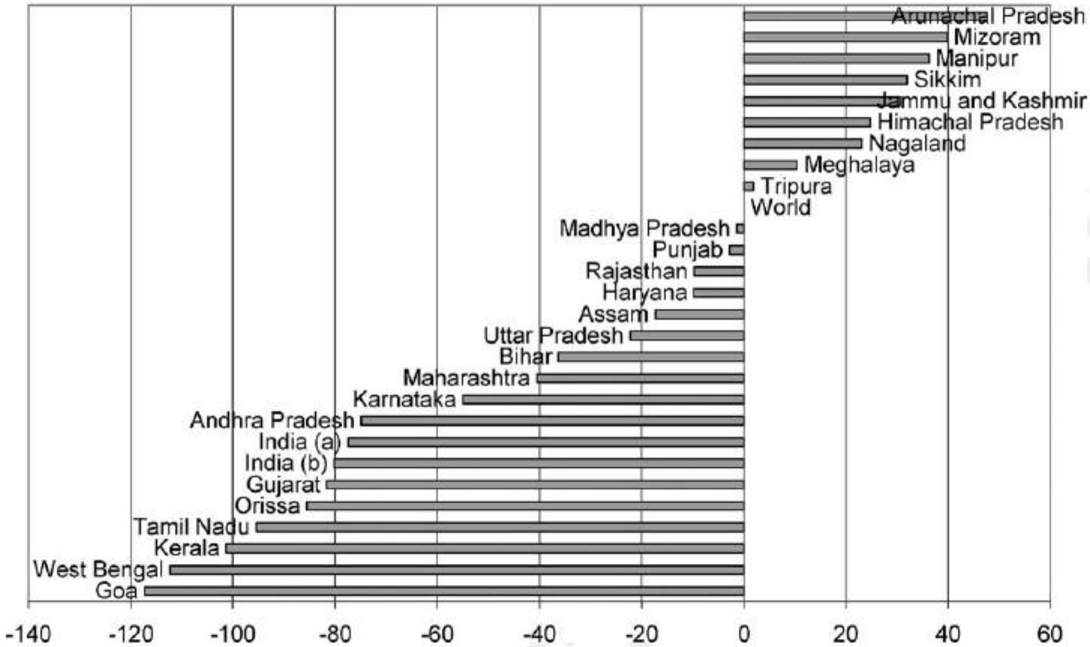
Chart A1.6: Relationship between Environmental Sustainability Index and Income



Source: World Bank (2007).

Brenkert and Malone (2005) have estimated the vulnerability of Indian states in the context of climate change. However, their analysis is based on current environmental sensitivity and coping capacity (which includes the economic well-being indicators). Chart A1.7 shows their results through a comparison of the vulnerability-resilience indicator values for Indian states. While six states are more vulnerable than India as a whole, a large number of states are more vulnerable than the global average. Given that the population proportion in the less vulnerable states (mostly the north eastern states) is fairly low, this study concludes that most of India is vulnerable due to environmental degradation.

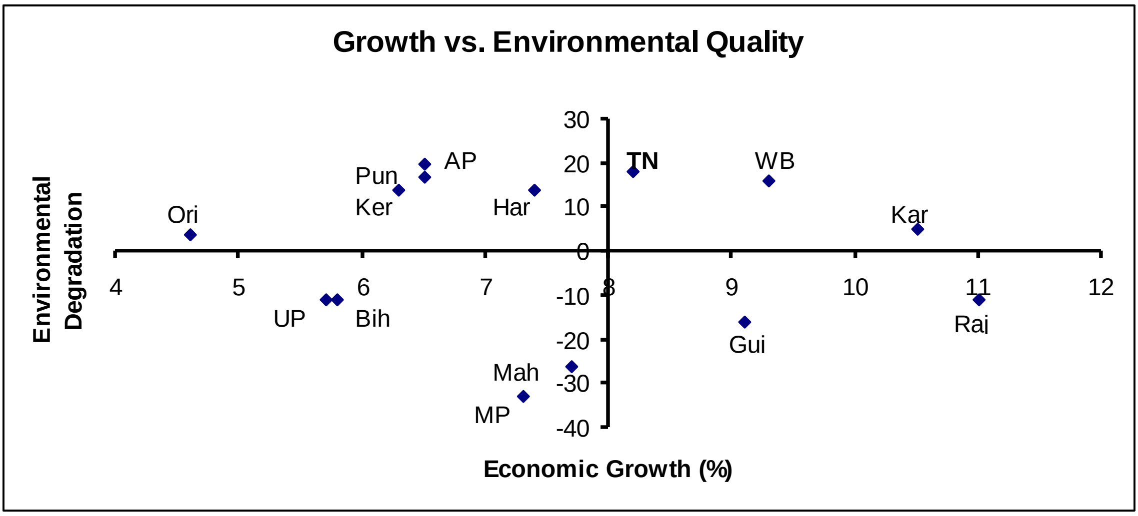
Chart A1.7: Vulnerability-Resilience Indicators for Indian States



Source: Brenkert and Malone (2005).

Mukherjee and Kathuria (2006) compared economic growth in major states of India against the observed environmental degradation. The environmental quality is captured through integration of some fourteen indicators and the environmental degradation in each state is assessed in terms of the change in the environmental quality over 1990s. Chart A1.8 below shows the trade off between economic growth and environmental quality across Indian states. The study concludes that Tamil Nadu, along with West Bengal and Karnataka registered higher economic growth during 1990s at the cost of environmental quality. While Orissa, Punjab, Kerala, Andhra Pradesh, and Haryana have registered significant environmental degradation without associated and corresponding improvements in the economic growth.

Chart A1.8: Economic Growth *vs*. Environmental Degradation

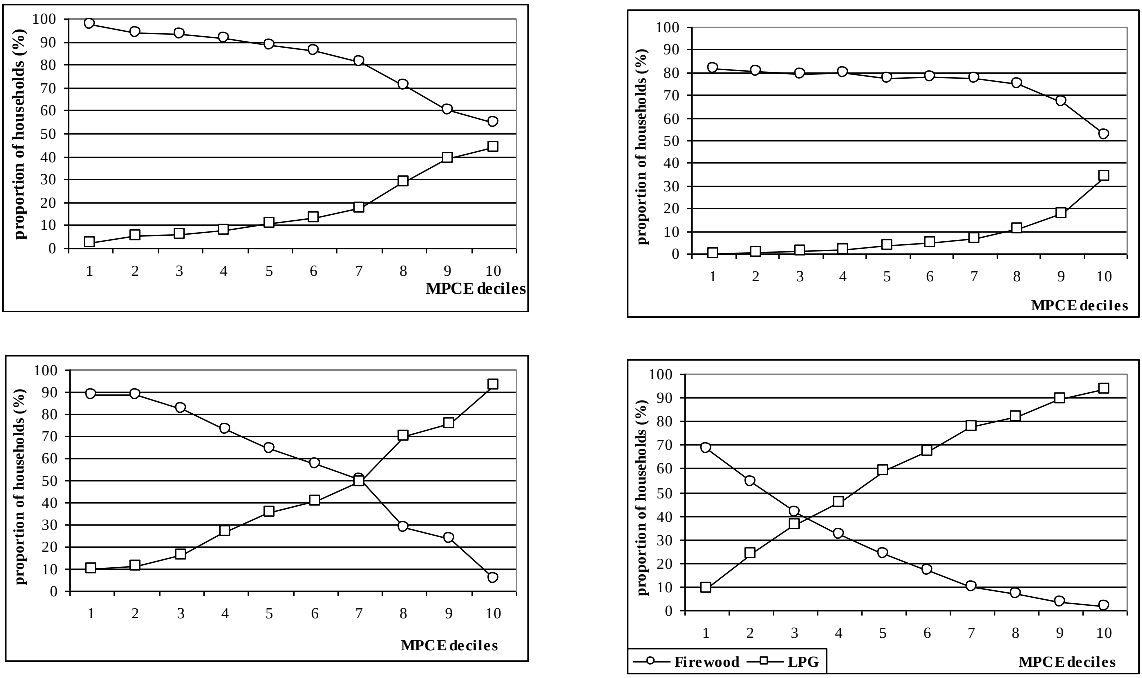


Source: adopted from Mukherjee and Kathuria (2006).

Income of course is one of the main factors influencing the penetration of 'cleaner' fuels, and there are clear differences between rural and urban areas. Besides income, the rural-urban differences can be attributed to the mismatch in the distributional system of the 'cleaner' fuels in rural and urban areas. In rural areas, lack of access to electricity prompts households to utilize kerosene for lighting. Further, the LPG distribution has not been very effective in rural areas, leading to problems associated with refilling of the cylinders. Also, the easy access to solid fuels prompts even the richer households to use these fuels for cooking.

Chart A1.9 shows the proportion of households using firewood and LPG as primary fuels for cooking across monthly per-capita expenditure deciles in rural and urban areas for India and the state of Kerala. The upper graphs depict the rural scenario and the lower graphs show the situation in the urban areas. Most striking feature of the graphs is the cross-over lines in the urban Kerala as compared with the all-India scenario. In all-India graph, the LPG dominates over firewood in the third MPCE class itself, whereas in Kerala the dominance does not manifest till the seventh MPCE class.

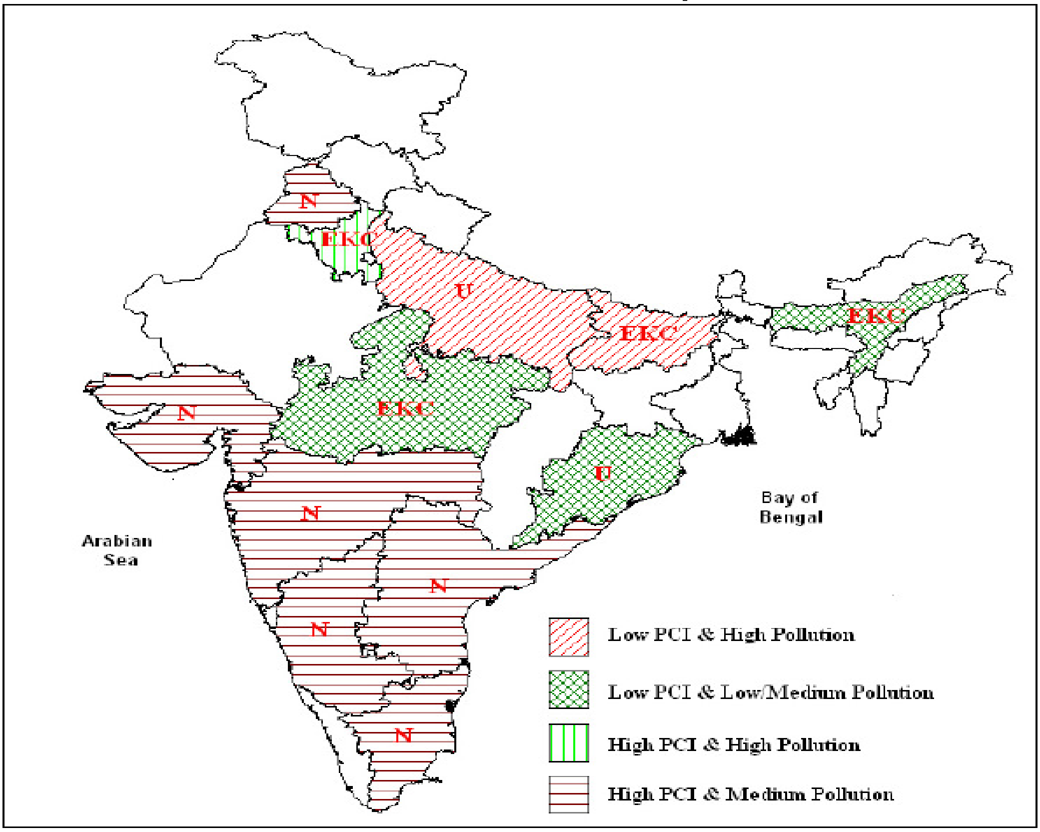
Chart A1.9: Households using Firewood and LPG across MPCE Deciles – 2004-05



Kerala **All-India**

Barua and Hubacek (2008) have analyzed the relationship between per capita income and water pollution (measured through BOD and COD) for major states of India over the period 1981 to 2000. Significant relationship was found in twelve out of the sixteen states. Most importantly, the study established that in most states the relationship between income and pollution has 'N' shape – indicating that with increase in income pollution declines first, but then increases again at higher levels of incomes. Chart A1.10 shows the estimated pollution-income relationship based on the pollution load across states of India. In the figure the indices 'N', 'U' and 'EKC' represent the income-pollution relationship either as 'N' shaped, or 'U' shaped, or 'inverted U' shaped.

Chart A1.10: Income-Pollution Relationship for Water Pollution



Source: Barua and Hubacek (2008).

Finally, Managi and Jena (2008) in their state level analysis have analyzed the issue of whether pollution abatement technologies are utilized efficiently. Based on panel data analysis, the authors argue that while in case of SO2 the generation of new technologies to reduce SO2 is more efficiently implemented, the scenario is not so bright in case of other pollutants such as NO2 and SPM. They further observe that environmental productivities decrease more in high-income states than in the low-income states.

In sum, for meeting the sustainable development goals the ongoing industrialization and urbanization need to be complemented with effective environmental management through appropriate intervention strategies. Eco-taxes and eco-subsidies could serve as the effective fiscal intervention strategies.

Appendix 2

ENVIRONMENTAL PUBLIC GOODS AND ECO-TAX REVENUE

Nature serves as natural sink for the pollution generated by the anthropogenic activities. If the pollution is within the carrying capacity of the natural sink, local pollutants such as suspended particulate matter, sulphur dioxide etc. is absorbed by the nature[1]. However, this extremely useful function of the nature fails if the pollution flow rate exceeds the absorption capacity of the nature. Thus, nature serves as environmental public good neutralizing the adverse effects of the pollution. Nature's public good contribution can be enhanced through anthropogenic interventions such as cleaning-up of rivers, restoring the nutrient balance of soils, afforestation and other programmes.

In this context, eco-taxes can serve two purposes: one, stem the flow of additional pollution by discouraging the use of polluting inputs and outputs (disincentive effect), and two, generate additional revenue which can be used partly or fully for providing environmental public goods (revenue effect). An important issue is whether eco-tax revenue should be fully earmarked for environmental public goods.

In taxation, there is no quid pro and one to one relationships between tax payments and services provided are generally avoided. This is because public goods are characterized by properties of non-excludability and non-rivalry. Demand for public goods is likely to remain understated as people know that they cannot be excluded from its consumption, and they need not reveal how much tax price they are willing to pay for the public good. This problem remains for environmental public goods also. People are not likely to reveal what is the value of environment to them if they have to pay for it. The link between tax price and provision of environment public good would therefore lead to an understatement of demand for such goods or resistance to tax payments for the provision for such goods. They would argue for shifting the burden of taxation to future generations for financing remedial treatment of the environment and go on adding to the stock of pollution.

A suitable analytical framework for examining this issue is the concept of 'social marginal cost of public funds' (SMCPF). The supply of all public goods/projects including the environmental public good can be determined by reference to the principle of 'social

[1] This does not apply to the global pollutants like carbon dioxide, whose life-time is typically in excess of several decades.

marginal social cost of public funds'. The social marginal cost of public funds is defined as the ratio between the shadow price of tax revenues and the population average of the social marginal utility of income. Given social utility and cost functions, the SMCPF analysis leads to the following result for determining the size of public goods:

$$B' = \eta C' \qquad (1)$$

Here, B′ is the social marginal benefit of the provision of public goods and C′ is the social cost of the provision of such goods and η is the social marginal cost of the public funds. Marginal social benefit may be derived from a social utility function defined over private (x) and public goods (y)

$$U = U(x, y) \qquad (2)$$

For an optimal tax system, η should be equal to 1 (Lundholm, 2005). This implies that if the provision of public goods is financed with an optimal tax system, the social marginal benefit of public goods should be equal to social marginal cost of provision of such goods. However, if the system is using distortionary taxes, the value of η may be higher than 1, which implies that in the presence of taxation inefficiencies, public goods should be provided to the extent such that the social marginal benefit of the public goods is higher than the social marginal cost of providing the public goods finance by taxation to account for welfare loss due to distortionary taxation. It may be noted that there are various measurement issues concerning the social marginal cost of public funds and different authors have often used the term with different meanings[1].

Starting from equation 1, any substitution of distortionary taxation by environmental taxes will reduce the value of η, say by a fraction λ (<1) and therefore would be welfare improving even without provision of environmental public goods. Ignoring the disincentive effects of environmental taxation, if resources are fully employed and there is no change in the quantities of private and public goods, this would imply improvement in welfare because the deadweight and inefficiency costs of taxation will go down. If resources are not fully employed, existing supply of public goods can be increased (even that of non-environmental public goods) leading to increase in total social benefit. The process can be pursued up to the point where environmental taxes force the economy to lower production possibility frontiers when substitution possibilities

[1] There are two traditions in the literature in this context (see, e.g. Ballard and Fullerton, 1992). In the Harberger-Pigou-Browning tradition the marginal cost of public funds is always larger than unity and the Dasgupta-Stiglitz-Atkinson-Stern tradition where it may be larger or lower than one. In the first tradition the marginal project is a lump sum transfer to a representative consumer financed by a distortionary tax.

between polluting goods are exhausted given the state of technology. At the same time an additional source of social benefit is the reduction in the use of polluting goods leading to better environment yielding direct benefits to the society.

In this framework we may now introduce the provision of environmental public goods, say by dividing the public goods into two components non-environmental public goods and environmental public goods.

The social utility function is then

$$U= U(x, y(y1,y2)) \qquad (3)$$

The marginal social benefit of public goods will then depend on both non-environmental and environmental public goods. There will now be interaction terms between non-environmental and environmental public goods. First, as the quality of environment improves, there will be reduction for the need for both private and public sector provision for health services, for example. The released resources from the general pool of taxes can then be used for environmental public goods. Similarly, higher provision of better and wider roads or better traffic management, which is a non-environmental public good will reduce carbon emissions and reduce say, the need for providing additional forestation.

Thus, the provision for environmental public goods will require the expansion of the public sector but because of interactions between private goods, non-environmental, and environmental public goods, environmental tax revenues can be used to enhance welfare by adjusting the supply of non-environmental as well as environmental goods and/or reducing the MSCPF. A one to one relationship between environmental taxes and environmental public goods is not necessarily warranted.

Earmarking of specific tax revenues for specific purposes can be done only in a limited way by making the environmental tax as a cess. For all other environmental taxes, the decision for allocation across different budget heads under our constitutional arrangements is the prerogative of the Parliament and state legislatures according to the priorities reflecting preference of the voters.

Some other relevant considerations may be listed as follows:

a. For a society, given the law of entropy, it may often be impossible to restore the environment to its original position after having been polluted. It may be physically not possible or technologies may not exist for the purpose or it may be prohibitively costly to clean up the environment. The key to maintaining acceptable quality of environment is therefore to keep in check the current flow of pollution that adds to the stock of pollution. The distinctive effect of eco-taxes may be far more important than the revenue effect.

b. There are important intergenerational issues in the need to correct for the stock of environmental pollution. This stock is the outcome of the cumulated contributions of all previous generations. How much of this needs to be corrected by the current generation can be decided by the current generation in conjunction with how much tax-price they would be willing to pay for it if it the tax-price is entirely additional.

c. Some part of pollution, particularly in the context of climate change has global dimensions. Any single country may not be willing to pay the tax-price for the provision of mitigation. A one to one link between tax revenue and environmental public goods and subsidies is difficult to establish in a country-specific context because of global externalities.

d. There is a difference between the tax-GDP ratios of developed and developing countries, the former being much higher than the latter. In developed countries the environmental tax reform entails using a significant part of the revenue for reducing other distortionary taxes as the political acceptability of a higher tax burden is very limited. In developing countries where the tax-GDP ratio is still low, environmental taxes may provide a route for increasing the tax revenue and increasing the size of government, which may use the additional revenues for both environmental and non-environmental public goods.

In deriving practical results, there are measurement difficulties both in relation to SMCPF and the social utility function. In one of the earliest papers on the concept and measurement of marginal cost of public funds, Browning (1976) observes: "It is important to recognize that it is literally impossible to determine the exact source of finance when governments use general fund financing (enacting tax and expenditure bills separately). In this type of situation, what is clearly needed is a convention or rule of thumb…this convention should represent a judgment of the type of change that a government typically makes when more or less revenue is required." Such conventions will need to be different between developed and developing countries. In the former, where the tax-GDP ratios are high, it will be difficult to use environmental tax revenue aimed at increasing the tax-GDP ratio. In this case, environmental taxes will mostly be used to replace conventional distortionary taxes, and most of the revenue will be used for general public goods. Discussions with experts suggest on an anecdotal basis that 85 % of environmental tax revenue can be used for general public goods and 15 percent for environmental public goods. In developing countries, environmental taxes can be used to some extent in increasing the tax-GDP ratio and a higher percentage can be allocated for environmental public goods.

Appendix 3

GREEN TAX REFORM: INTERNATIONAL EXPERIENCE

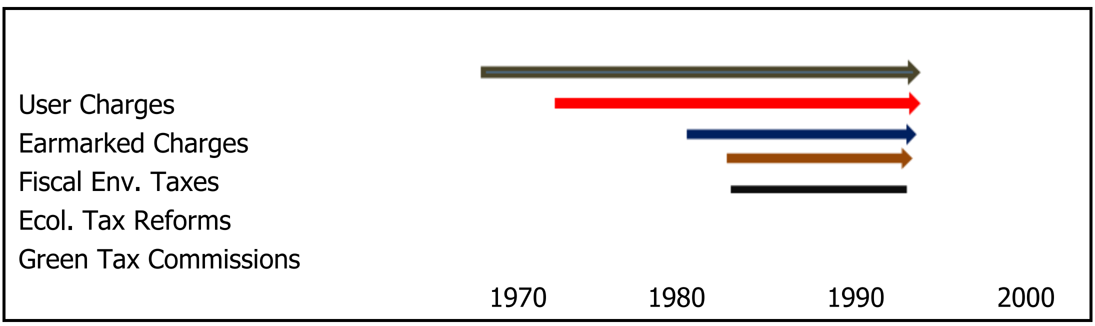
3.1 Introduction

Green tax reform in different countries across the globe mainly aims at shifting the tax burden from factors of production, such as labour and capital, to pollution and the use of natural resources. Elements of Strategic tax reform generally involve three complementary activities. These are:

i. Removal of existing taxes and subsidies that have negative environmental impacts,
ii. Restructuring of existing taxes in an environmentally friendly manner, and
iii. Introducing new environmental taxes.

Extensive tax reforms have been applied in the area of green taxes in the sub-continents and countries of Europe, Canada, Australia and New Zealand. In the last three decades, generally these taxes have evolved gradually in sequence beginning with user charges. This implied cost recovery mechanism as well as earmarked charges in the early phase. In the later phase of environmental policy, the emphasis has been on environmental taxes and ecological reforms with the supportive role played by green tax commissions (Char A3.1). Yet the role of environmental taxes has been rather marginal and often acts as an add-on to other policy measures (EEA, 2000).

Chart A3.1: General Chronological Evolution of Environmental Taxes



Source: Eurostat (2000).

Table A3.1: Development of Environmental Tax Bases in EU Member States, 1996-2000 (with Indication of Year of Introduction of CO_2 Taxes)

Tax on	A	B	DK	FI	FR	GE	GR	ICL	IRL	IT	L	NL	NO	P	SP	SW	UK
Energy																	
CO2 *			1992	1990	2001	1999				1999		1992	1991			1991	2001
Transport																	
Diff annual car tax																	
$ in car fuel																	
Water effluents																	
Waste-end																	
Dangerous waste																	
Tyres																	
Disposable razors																	
Beverage containers																	
Disposable cameras																	
Raw materials																	
Packaging																	
Bags																	
Disposable tableware																	
Pesticides																	
CFCs																	
Batteries																	
Light bulbs																	
PVC/phtalaters																	
Lubricatin oil																	
Fertilisers																	
Paper, board																	
PE																	
Solvents																	
Aviatin noise																	
Nox																	
SO2																	
Minterals (P,N)																	
		in 1996			new in 2000 * years of introduction												

Source: EEA, 2000.

Note: A=Austria; B=Belgium; D=Denmark; GE=Germany; GR=Greece; FI=Finland; FR=France; ICL=Iceland; IRL=Ireland; IT=Italy; L=Luxemburg; NL=Netherlands; NO=Norway; P=Portugal; SP=Spain; SW=Sweden; UK= United Kingdom

Largely the emphasis in environmental taxes is on energy and transport. Yet over the years new tax bases have been used. For instance, waste end taxes (in Austria, Finland, France, Greece, Italy, Sweden, Norway and UK), packaging (in Italy), solvents (Denmark and Norway), PVC/ phthalates (Denmark) and annual car taxes differentiated according to environmental characteristics (Germany) (EEA, 2000). Table A3.1 below depicts this development for EU member States.

The available evidence suggests that many of these taxes in Europe provide incentives to economize and help to reduce pollution emissions and activities. A particular mention is made of such taxes as Swedish NO_2 Charge, German and Dutch water pollution charges and the UK waste disposal taxes. In terms of source of revenue, for general budget or earmarked taxes, these have been increasing in importance in central and eastern European countries. Table A3.2 below depicts this effectiveness for European countries. Likewise Table A3.2 (a), (b) and (c) indicate the quantitative significance of Energy and carbon-based taxes and waste taxes in the countries of Europe for the latest available years

Table A3.2: Some Environmental Taxes in Europe and their Effectiveness

Tax on	Applied in	Evidence of Effectiveness
Motor fuels	All European Countries	Some impact reported on vehicle fuel consumption (e.g. in case of UK Fuel Duty Escalator) Main short-term impact is substitution in response to tax differentiation (e.g. lower rates for unleaded petrol, in many countries, and low-sulphur fuels, e.g. in Denmark and Sweden)
Other energy use (including carbon and sulphur taxes)	Many European Countries	Clear energy-efficiency improvements and fuel substitution observed in countries with highest tax rates (e.g. Denmark, Finland, Sweden) Co2 taxes reviewed positively in Scandinavia and Finland Rate differentiation (e.g. by sulphur content) leads to substitution processes
Motor vehicles registration or sale	Many European Countries	Some evidence of downward impact of high fees on car ownership; registration tax differentiated by environmental classification in Sweden, but financial impact marginal, and environmental impact mainly "soft"
Motor vehicles ownership/use (annual taxes)	Most European Countries	Mostly differentiated according to weight or cylinder content; recently differentiated according to emissions in Germany; no evidence of effects
Motor vehicles use (road pricing, tolls etc.)	Several European Countries	Usually applied as a cost-covering charge; evidence of effectiveness as an environmental policy instrument is lacking
Industrial emissions to air and water (measured)	Several European Countries	Clear incentive effect in a limited number of cases (e.g. Swedish NO_x charge; Dutch water pollution tax); elsewhere main effectiveness through recycling of revenues to environmental investments (e.g. France, several accession countries)

Table A3.2: Some Environmental Taxes in Europe and their Effectiveness (Contd..)

Tax on	Applied in	Evidence of Effectiveness
Agricultural inputs (fertilisers, pesticides)	BE, DK, NO, SE, AT, FI	Limited direct impact on use; "soft signals" (awareness raising) possibly more important (e.g. when revenues used for financing training programme- Sweden)
"One-way" packaging and other disposables	BE, DK, EE, FI, HU, LV, NO, PL	Positive impact on re-introduction of deposit-refund systems observed in Estonia; impact not clear elsewhere
Chemical substances (e.g. solvents, CFCs)	BE, CH, CZ, DK, HU, IS, SK	Contribution to reduction in CFC use reported in Denmark
Batteries and accumulators	BE, DK, HU, LV, SE	Mainly instrumental in stimulating collection of spent batteries
Car tyres	DK, HU, LV, NL	Revenues used for financing treatment of spent tyres
Water abstraction	Several European Countries	Decrease in industrial groundwater use observed in the Netherlands after introduction of tax
Waste (apart from cost-covering charges)	A, DK, EE, FI, IT, NL, NO, SE, GB	Effective in several cases (e.g. Danish waste tax and UK landfill tax) on recycling, waste reduction, and shift from landfilling to incineration, reuse and recycling

Source: EEA (2000).

Note: A=Austria; B=Belgium; D=Denmark; GE=Germany; GR=Greece; FI=Finland; FR=France; ICL=Iceland; IRL=Ireland; IT=Italy; L=Luxemburg; NL=Netherlands; NO=Norway; P=Portugal; SP=Spain; SW=Sweden; UK= United Kingdom

Table A3.2 (a): Impact of Energy and Carbon-based Taxes

Country and Tax	Period Evaluated	Impact	Source
Finland- energy & carbon tax	1990-2005	• CO_2 emissions 7 percent lower than would have otherwise been • A shift from carbon tax to output tax on electricity in 1997 may have lessened impact	Nordic council 2006 Nordic Council 1999
Norway-Carbon & sulphur dioxide taxes	1991-2007	• 21 percent reduction in CO_2 from power plants by 1995 • 14 percent national reduction in CO_2 in 1990's, 2 percent attributed to carbon tax • 12 percent reduction in CO_2 emissions per unit of GDP	OECD 2001 OECD 2006 Nordic council 2006
Denmark- energy & carbon tax	1992	• CO_2 emissions in affected sectors down by 6 percent and economic growth up by 20 percent between 1988 and 1997 and a 5 percent reduction in emission in one year in response to tax increase • In 1990s a 23 percent reduction in CO_2 from as usual trend and energy efficiency increased by 26 percent • Subsidy to renewables may have accounted for greater proportion of emissions reductions than tax	OECD 2006 Nordic Council 2006
Sweden-energy & carbon taxes	1990-2007	• Emissions reductions of 0.5 million tons per annum • Emissions would have been 20 percent higher than 1990 levels without tax	Nordic council 2006 Swedish Ministry of Finance 2004
The Netherlands- energy tax	1999-2007	• Emissions 3.5 percent lower than would have otherwise been • Low tax rates may have limited impact	Finance ministry, the Netherlands 2007
Germany- environmental tax reform, taxes on transport , fuels & electricity	1999-2005	• CO_2 reduced by 15 percent between 1990 and 1999 and 1 percent between 1999 and 2005 • CO_2 emissions 2-3 percent lower by 2005 than they would have been without tax • German re-unification an important factor in reductions	EEA 2007 OECD 2006
UK-Industrial energy tax	2001-2010	• UK CO_2 emissions reduced by 2 percent in 2002 and 2.25 percent in 2003 and cumulative savings of 16.5 million tonnes of carbon up to 2005 • Reduction in UK energy demand of 2.9 percent estimated by 2010	Cambridge Econometrics 2005 HMT 2006

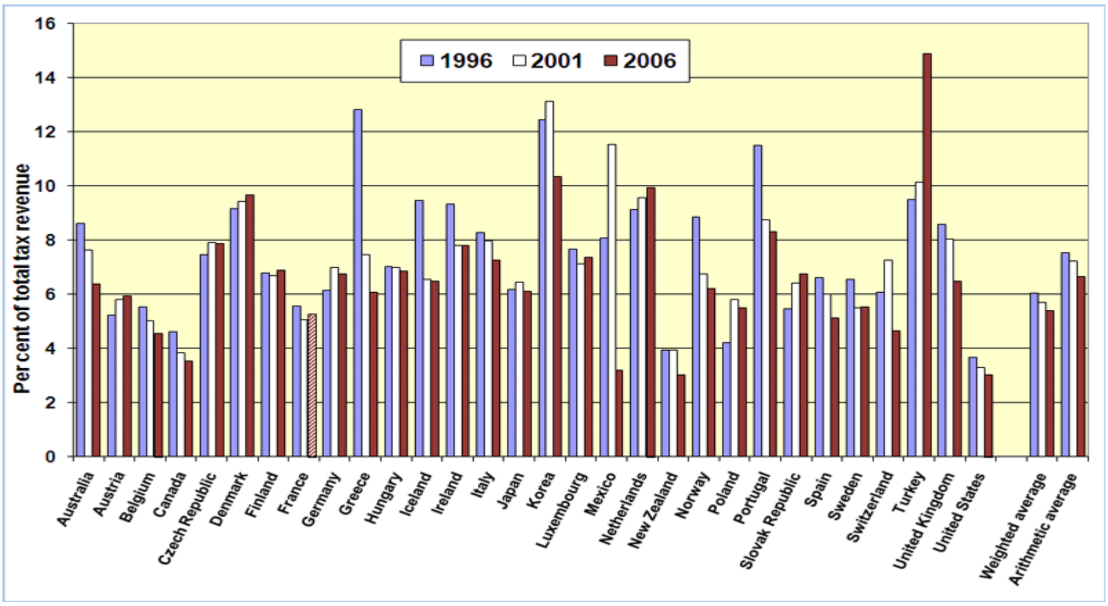
Table A3.2 (b): Impact of Vehicle Taxes

Country/region	Period Evaluated	Impact	Source
Europe-	No date	• Taxes means European vehicle fuel price three times that of US and European emissions half what they would be at US fuel price • European vehicle fuel efficiency 25-50 percent better than US	Sterner 2007 EEA 2005a
UK- fuel duty escalator	1993-1999	• Increases in fuel duty are estimated to have produced annual carbon savings of between 1 and 2.5 MtC by 2010 • Average fuel efficiency of lorries over 33 tonnes increased 13 percent between 1993 and 1998	DETR2000,p.92
Sweden-sulphur content of vehicle fuels	1980-1998 tax introduced in 1991	• Sulphur content of fuels fell 80 percent between 1980 and 1998	OECD 2006
Switzerland-Commercial vehicles tax - weight and distance based	2001-2002	• 5 percent reduction in commercial traffic in first year, compared with 7 percent increase in previous year	EEA 2005a, OECD 2005a
London-Congestion charge	2003-2004	• Congestion reduced by 30 percent and vehicle volume by 15 percent	
UK-vehicle excise duty	2002-2005	• Business mileage reduced by over 300 million miles per year • Overall effect has been estimated to have reduced by 2005 the emissions of carbon from the company car fleet by 0.7-1.8 $MtCO_2$, or up to 1.5 percent of overall CO_2 emissions from road transport in 2005 in the UK	HMT 2007

Table A3.2 (c): Impact of Waste Taxes

Country/ Region	Period Evaluated	Impact	Source
Denmark- household waste tax	1987-1996	• 26 percent reduction in waste delivered to municipal sites between 1990 and 1996	MEE-DEPA 2007
Finland- Waste taxes	1996-2007	• Reduced waste by 15 percent compared to a business-as-usual scenario. Packaging tax is said to have led to almost complete recycling rates for soft-drink packaging	Nordic Council 2006
Sweden- Waste taxes	1996-2006	• Production and consumption have grown by 7 percent, waste generation has declined by 0.5 percent • Total waste to landfill has fallen	Nordic Council 2006
UK- Landfill taxes	1996-2006	• Active waste disposed of to landfill fell by 14 percent between 1997-98 and 2005-06, while overall landfilled waste fell by 25 percent	

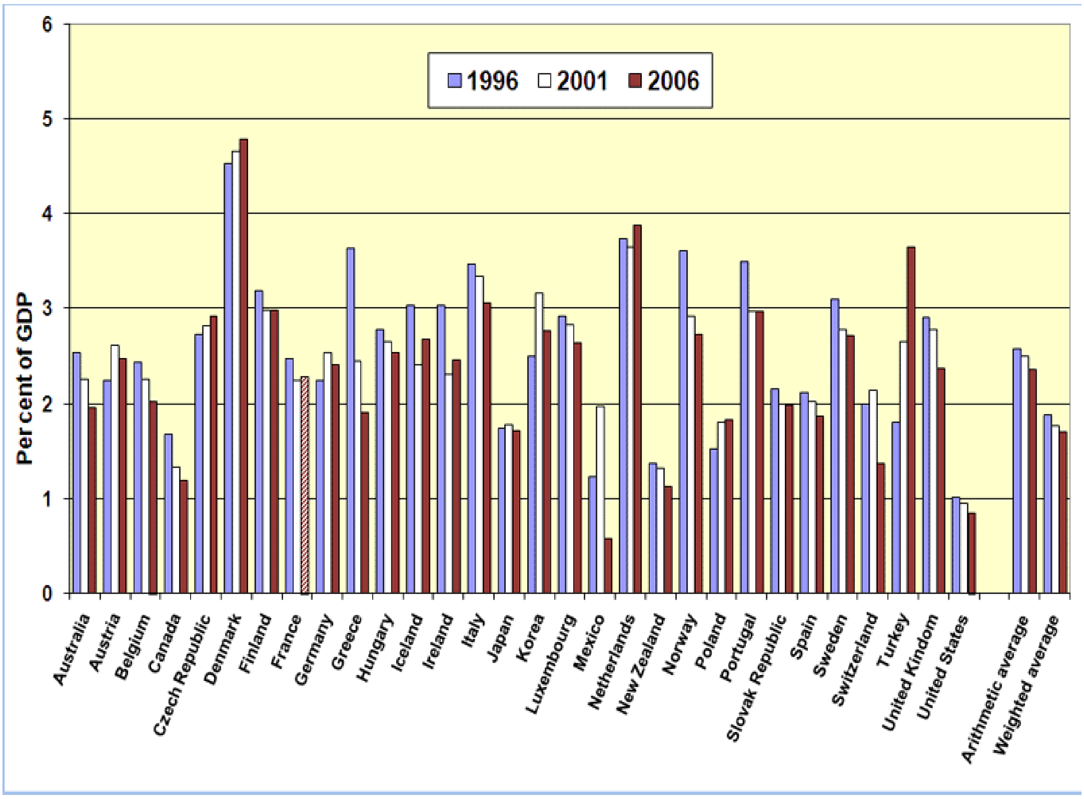
Chart A3.2: Revenues from Environmentally Related Taxes in Percent of Total Tax Revenue



Source: http://www2.oecd.org/ecoinst/queries/TaxInfo.htm

However, overall revenue potential over the decade 1996-2006 has been showing a declining trend for most of the OECD countries. This is depicted in Chart A3.2 and A3.3 below

Chart A3.3: Revenues from Environmentally Related Taxes in Percent of GDP



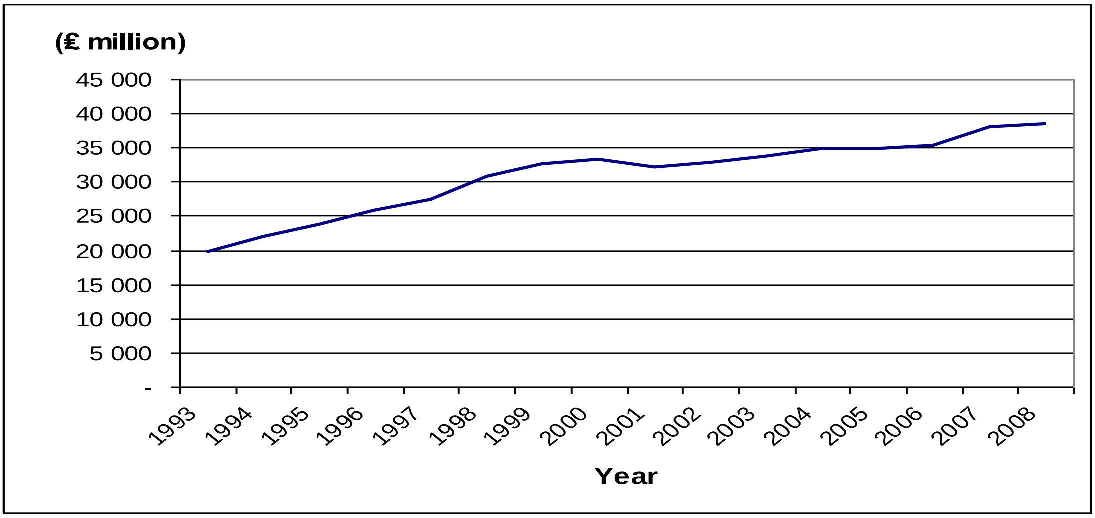
Source: http://www2.oecd.org/ecoinst/queries/TaxInfo.htm

Below we discuss the environmental taxes for some select countries which include European countries namely, UK, Germany and Sweden and other sub-continental federation of Canada and New Zealand. Major focus of individual country experience is on three dimensions, viz., types of taxes levied, revenues/ revenue potential and impact on environment pollution reduction.

3.2 Eco-Taxes in UK

Trends in eco tax revenue in UK from 1993 to 2008 are shown in Chart A3.4.

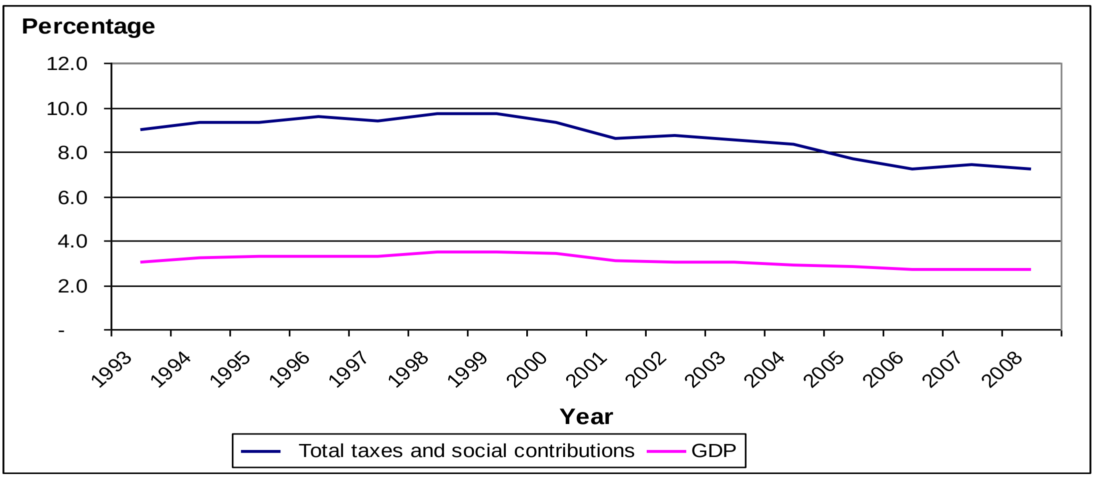
Chart A3.4: Revenue from Environmental Tax in UK



Source: http://www.statistics.gov.uk/statbase/Expodata/Spreadsheets/D5688.xls

The share of eco tax revenue as percentage of total taxes and GDP is shown in Chart A3.5.

Chart A3.5: Eco Tax Revenue as a Percentage of Total Taxes and GDP



Source: http://www.statistics.gov.uk/statbase/Expodata/Spreadsheets/D5688.xls

The above graphs show us that although in absolute terms, eco tax revenue has increased in the UK, revenue as a percentage of total taxes and GDP has declined over the years.

Environmental taxes in UK can be divided into three- transport taxes, resource taxes and energy taxes. Of this transport taxes, in particular fuel duty followed by the vehicle excise duty, forms a major part of the eco tax revenues. These taxes are explained below in detail.

a. Taxes on Transport

(i) Vehicle Excise Duty (VED)

(a) Structure

The VED is an annual tax on road vehicles first introduced in 1889. Till 1999, a flat rate tax was charged. In June 1999, this flat rate was reformed into a two tier system where, small cars with an engine size of less than 1,100cc paid a lower tax of ₤100 per year, while larger cars paid ₤155. In 2001, system of graduated VED (GVED) was introduced[1].Four bands based on the emission rating of the vehicle were introduced (Bands A to D). An additional band E was later added in 2002 and band F in 2003. In 2006, a seventh band G was added and the tax charged on cars with the lowest emission rating (Band A i.e. 100g or les of CO_2 per km) was reduced to 0. Tax paid under Band G was ₤210. Further reforms took place in the Budget of 2008. The number of bands for 2009 was increased to 13 (Bands A to M)[2]. From 2010, a new system will be introduced where news cars will be charged a different VED for the first year in which they are bought. This rate will be higher than standard rate for cars with high emissions and lower for cars with low emissions.

The VED for the years 2008, 2009 and 2010 for petrol and diesel cars registered on or after 1st March 2001 are given below. The VED for alternative fuels cars is lower (Table A3.3).

[1] Cars brought before 1st March 2001 remained under the two tier system. Cars with an engine size of less than 1,550cc paid ₤110 per year and lager cars paid ₤175 per year. Cars bought on or after 1st March 2001 now paid according to their emissions.

[2] The tax charged to cars with the highest emissions rating (Band M) was significantly raised to ₤440 per year. The VED for 2009 was later lowered. The tax charged under Band M is now ₤405

Table A3.3: VED Bands and Rates for Cars Registered after 1st March 2001

VED Band	CO_2 Emissions (g/km)	2008-09	CO_2 Emissions (g/km)	2009-10	2010-11	
		Standard Rate (£)		Standard Rate(£)	First Year(£)	Standard Rate(£)
A	Upto 100	0	Upto 100	0	0	0
B	101-102	35	101-110	35	0	20
C	121-150	120	111-120	35	0	35
D	151-165	145	121-130	120	0	95
E	166-185	170	131-140	120	115	115
F	Over 186[1]	210	141-150	125	125	125
G	Over 226[2]	400	151-160	150	155	155
H			161-170	175	250	180
I			171-180	175	300	210
J			181-200	215	425	270
K			201-225	215	550	310
L			226-255	405	750	430
M			Over 255	405	950	455

Source: Butcher (2009).

Note: [1]Cars registered before 23rd March 2006; [2]Cars registered on or after 23 March 2006.

The VED for the years 2008, 2009 and 2010 for cars registered before 1st March 2001 are given in Table A3.4.

Table A3.4: VED Bands and Rates for Private and Light Goods Vehicles Registered before 1st March 2009

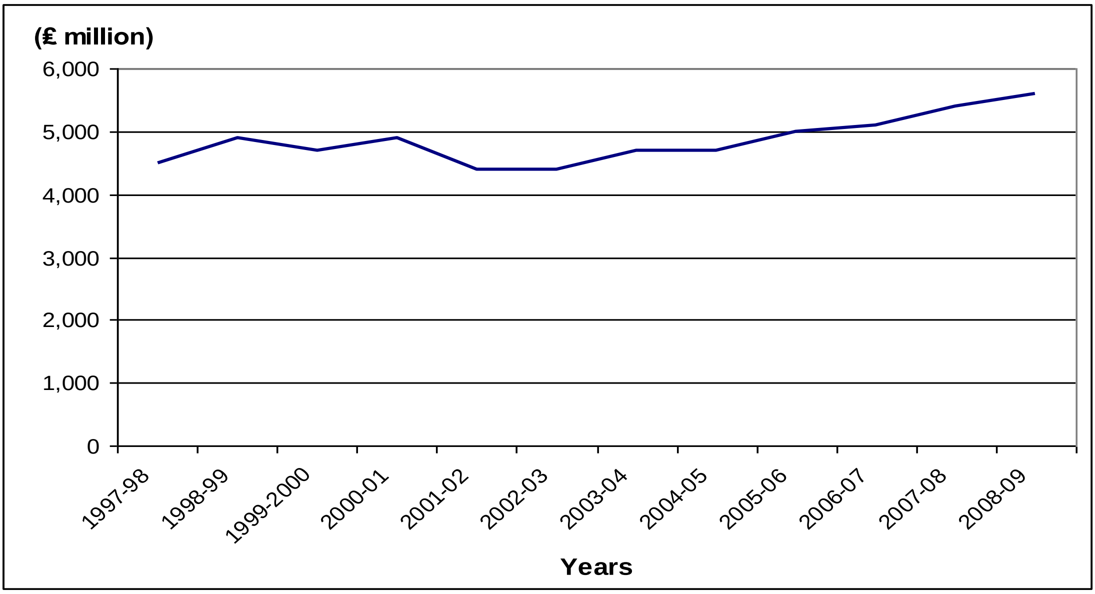
Engine Size	2008-09	2009-10	2010-11
1549cc & below	120	125	125
Above 1549cc	185	190	205

Source: Butcher (2009).

(b) Revenue

The revenue from the VED from 1997 onwards is shown in Chart A3.6.

Chart A3.6: Revenue from Vehicle Excise Duty



Source:http://www.publications.parliament.uk/pa/cm200809/cmhansrd/cm090511/text/90511w0008.htm

Revenue from VED has increased steadily since the reforms of 2001. The revenue for the year 2008-09 is £5600 million which is 1.28 percent of the total tax revenues of that year. It is estimated that the amount lost from evasion reduced from an estimated £79 million in 2007-08 to £49 million in 2008-09. This is equivalent to about 0.9 percent of the total revenue that could be raised in that year (Butcher, 2009).

(c) Impact

VED represents a fixed cost of car ownership. As such, it does not give an incentive to drive less. Instead, it provides an incentive to buy more fuel efficient cars and encourages motorists to scrap older and more polluting cars. Data has shown that the average emissions rating of new cars purchased have been declining over the years. It has reduced from 190 g/km in1997 to 165 g/km in 2007, a drop of 13 percent (Butcher, 2009). This is still far above the EU target of 140 g/km by 2008-09. Further evidence has shown that since 1997, there has been a changing of consumer preferences away from cars that come under higher bands. However, these trends existed even before the reforms in 2001. Thus, it is hard to disentangle the contribution made by reforms to VED and changes made to the manufacturing process or changing preferences (Leicester, 2006). The VED is expected to not adversely affect the poor as it is less likely that the poor own cars. However, there is no evidence to prove or contradict this.

(ii) Fuel Duty

(a) Structure

The fuel duty is the largest and most controversial eco tax in the UK. It was introduced in 1909 at 3d per gallon. It was abolished in 1919 and reintroduced in 1928 at 4d per gallon. The 1993 budget introduced the fuel price escalator. This meant that the fuel duty would be increased by at least 3 percent above the normal rate of inflation. The escalator was increased to 5 percent in 1995 and then to 6 percent in 1997 before being abandoned in 1999. Real fuel duty has decreased since then. This can be seen from the Figure A3.7, which shows the real duty rates of ultra low sulphur petrol (ULSP) and ultra low sulphur diesel (ULSD).

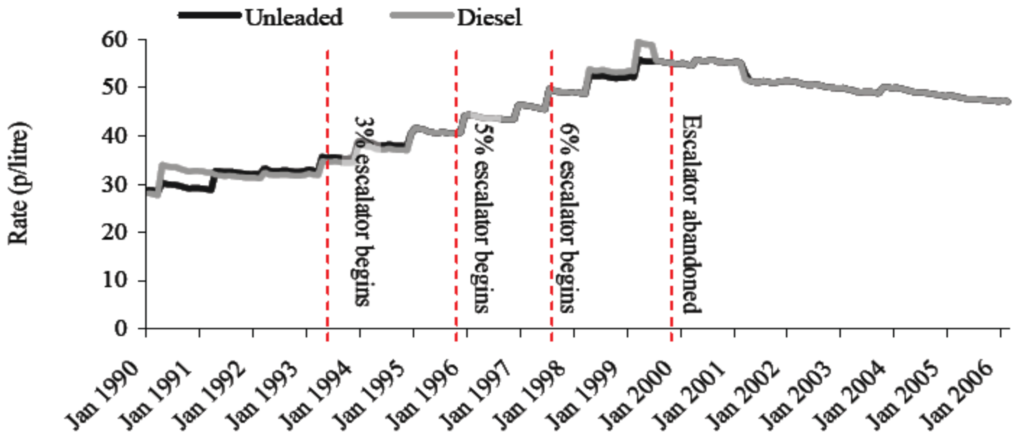


Chart A3.7: Real Duty Rates on ULSP and ULSD

Source: Leicester (2006).

The fuel duty rates for 2009 are given in Table A3.5.

Table A3.5: Fuel Duty Rates as on 01.09.09

Motor Spirit (pence per litre)	Leaded petrol and other light oils	65.91
	Unleaded petrol	56.19
	Ultra low sulphur petrol	56.19
	Sulphur free petrol	56.19
	Bioethanol	36.19
Diesel (pence per litre)	Diesel	56.19
	Ultra low sulphur diesel	56.19
	Sulphur free diesel	56.19
	Bio diesel/blended	36.19
Aviation gasoline (pence per litre)	Aviation gasoline	34.57
Rebated heavy oil (pence per litre)	Fuel oil	10.37
	Gas oil	10.80
Road fuel gasses (pence per kg)	Natural gas	22.16
	All other gasses	27.67

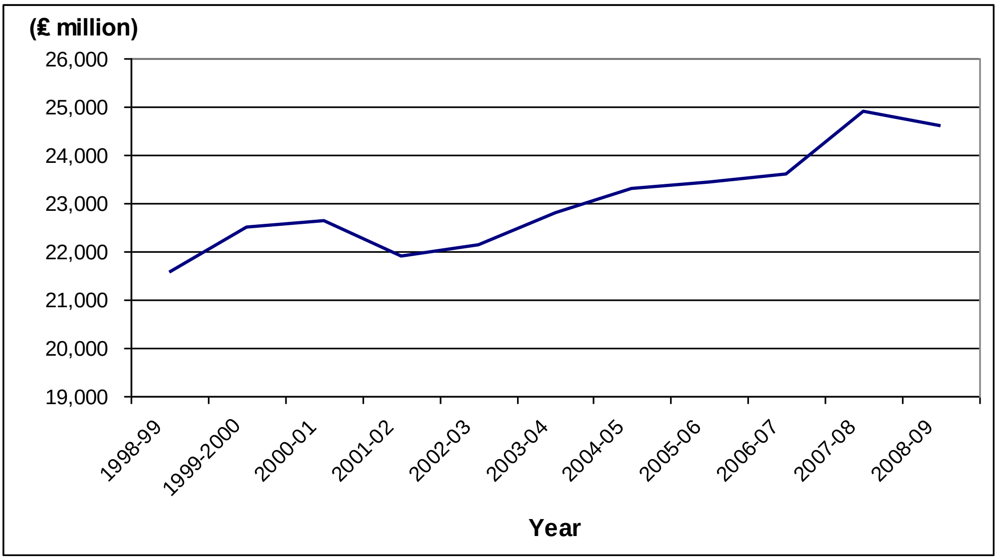
Source: https://www.uktradeinfo.com/index.cfm?task=bulloil&hasFlashPlayer=true

More polluting fuels such as leaded petrol and diesel are charged a higher rate. From 1 April 2008, ultra low sulphur petrol and sulphur free petrol became liable to duty at the same rate as unleaded and ultra low sulphur diesel and sulphur free diesel became liable to duty at the same rate as diesel.

(b) Revenue

Fuel duty is the largest source of green tax revenue. The revenue from fuel duty from the period 1998 to 2009 is shown Chart A3.8. The share of petrol and diesel in the total fuel duty revenue is depicted below in Chart A3.9.

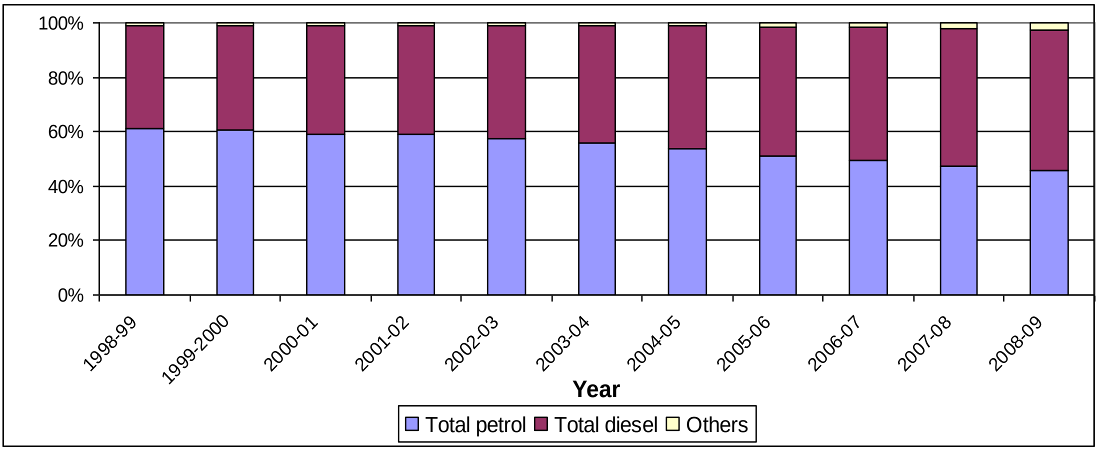
Chart A3.8: Revenue from Fuel Duty



Source: https://www.uktradeinfo.com/index.cfm?task=bulloil&hasFlashPlayer=true

Chart A2.4 shows the fuel duty revenue over the years. Revenue increased till 2000 where there is a dip. This is probably due to the abolition of the fuel escalator. Since then revenue has increased continually, peaking at £24,905 million in 2007-08. The revenue for 2008-09 is £24,615 million, which is 5.64 percent of the total tax receipts. The chart A2.5 shows the share of petrol and diesel in total fuel duty revenues. It can be seen that the share of diesel has overtaken that of petrol. In 2008-09, around 45 percent comes from petrol, while around 51 percent comes from diesel.

Chart A3.9: Share of Petrol and Diesel in Total Fuel Duty Revenues



Source: https://www.uktradeinfo.com/index.cfm?task=bulloil&hasFlashPlayer=true

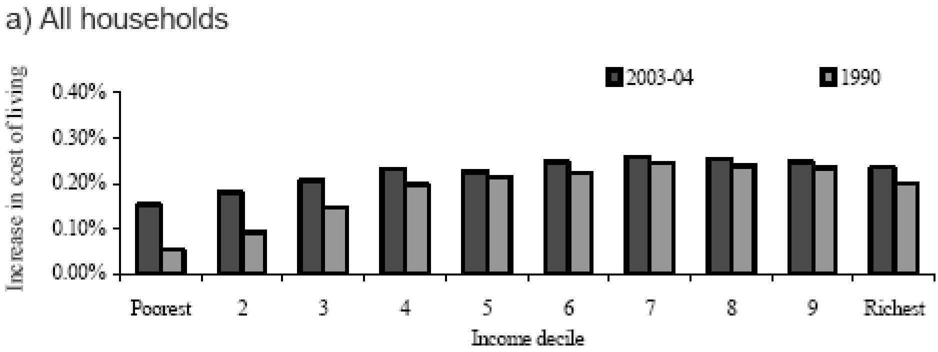
(c) Impact

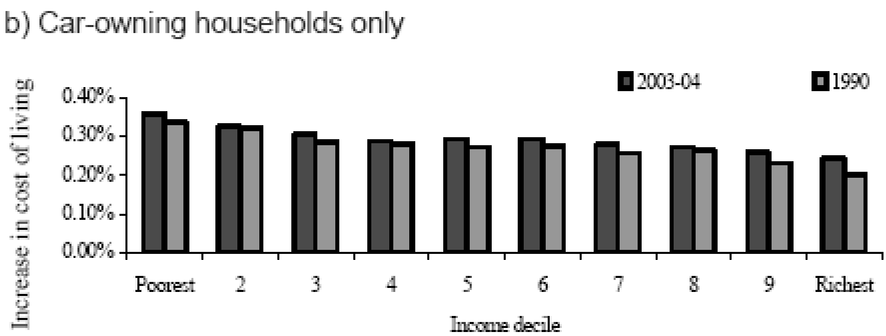
Unlike the VED which is a fixed cost of car ownership, fuel duty represents the marginal cost of driving. As such it is expected to reduce the number of trips made. In the long run, it also encourages people to buy more fuel efficient cars.

The impact of fuel duty on driving depends on the own price elasticity of demand for petrol which is in turn affected by the availability and price of substitutes such as public transport and alternative fuels. Studies suggest that a 10 percent rise in the price of fuel reduces fuel consumption by around 2.5 percent and traffic volume by 1 percent after a year, all other things remaining constant (Leicester, 2006).

With regard to the distributional impact of a fuel tax, it is expected to affect the poor more since the tax rate is the same across the income distribution. However, it may be progressive if the poor do not own cars or if the rich own inefficient car that use a lot of fuel. Leicester (2006) looks at the distributional impact of a 5 percent rise in fuel price. He looks at its effect across all households and across car owning households only. This is shown in Chart A3.10:

Chart A3.10: Distributional Impact of a 5 percent Fuel Price Rise





Source: Leicester (2006).

It shows the effect of the fuel price rise on all households. This is clearly not regressive with the 7th and the 8th decile bearing most of the impact. However, in 2000, the impact has increased more strongly for the bottom deciles. This is due to an increase in car ownership. Looking at only car owning households (Chart A3.10 b), the impact is certainly regressive.

(iii) Air Passenger Duty (APD)

(a) Structure

The APD was introduced in 1994. It is a tax levied on airlines based on the number of passengers flying domestically or internationally from UK airports (other than flights from the Scottish highlands or the Islands)[1]. It was originally not levied as an environment tax

[1] Exemptions from APD include small aircrafts of less than 10 tonnes or with fewer than 20 passenger seats, children under 2 years of age, who do not have their own seats, trips on connecting flights and short pleasure flights of les than 60 minutes

but because it was felt that air travel was under taxed compared to other sectors due to zero rating for VAT and low or no fuel tax. However, it can be regarded as one as it does make one aware of the externalities of caused by the aviation industry. The air passenger duties since 1994 are given in Table A3.6.

Table A3.6: APD Rates 1994-2009

Date of Change	**EU Rate (£)**		**Non-EU Rate (£)**	
1-Nov-94	5		10	
1-Nov-97	10		20	
	Economy Class	**Higher Classes**	**Economy Class**	**Higher Classes**
1-Apr-01	5	10	20	40
1-Feb-07	10	20	40	80

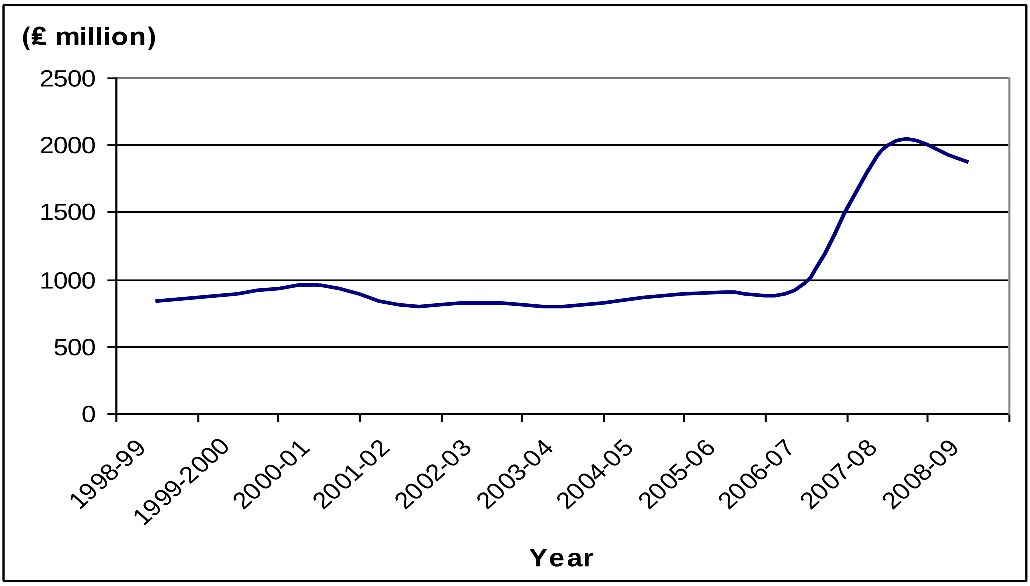
Source: https://www.uktradeinfo.com/index.cfm?task=bullair

In 1994 there were just two rates – Domestic and EU/European Economic Area (EEA) destination flights were charged £5 while non EU/EEA destinations were charged £10. These rates were doubled in 1997. The structure of the tax was changed in 2001. People travelling by economy class pay lesser than those travelling by higher classes. The rates were doubled again in 2007.

(b) Revenue

The revenue from APD till 2009 is depicted Chart A3.11.

Chart A3.11: Revenue from Air Passenger Duty



Source: https://www.uktradeinfo.com/index.cfm?task=bullair

The APD is a relatively small tax in revenue terms. The revenue from APD has increased over the years. There was a small dip in revenues following the reforms in 2001. Revenues rose sharply after the doubling of rates in 2007. The revenue for 2009 is £1862 million, which is around 0.4 percent of the total tax revenue.

(c) Impact

APD increases the marginal cost of flying to the customer and therefore, is expected to reduce the number of times a person flies. Its effectiveness depends on the price elasticity of air travel which has been estimated by studies to be quite low. A Canadian review estimated that a 10 percent increase in price would reduce demand for long haul business flights by 2.5 percent and short haul business flights by 7 percent. Demand for long haul leisure flights are reduced by 10 percent and short haul leisure flights by 15 percent (Leicester, 2006).

Various measures to improve the impact of the APD on emissions are suggested (Leicester, 2006). These include taxing the flight instead of individual passengers, taxing according to the distance and taxing according to the type of aircraft and its fuel efficiency. Distributional impact of APD depends on the number of flights taken across income classes. Since the reforms of 2001, APD is likely to have become less regressive.

(iv) London Congestion Charge

(a) Structure

The congestion charge was introduced in central London in 2003 in order to reduce the level of congestion. The charging zone is an area of 22 sq kms. The charge is applicable to any vehicle entering or parking in the zone between 7 am and 6.30 pm on a weekday. The charge was originally set at £5 per day, but was increased to £8 in 2005[1]. However, this charge also included provision of exemptions[2].It is estimated that around 150,000 drivers are eligible to make the payment each day. The revenue from the congestion charge was £137 million in the year 2007-08[3]. By law, this revenue has to be invested back into the London's transport system.

(c) Impact

The monitoring report of Traffic for London (2006) suggests that congestion has fallen by around 25-30 percent relative to pre charging baselines. This charge has also reduced carbon emissions by around 16 percent within the charging zone by allowing traffic to flow more freely and reducing time spent idling in traffic queues and it is likely to increase demand for public transport by around 1-2 percent (Blow *et al*, 2003)

(v) Taxation of Company Cars

I. Structure

Company cars are given as a benefit in kind to employees. Under the company car tax, this benefit is taxed by allocating it a cash value. On this cash value, company car drivers are liable to pay income tax and employers are liable to pay Class 1A National Insurance Contributions (NICs).

Before April 2002, the taxable value of the car was calculated based on the list price if the car and its mileage. The value was 35 percent of the list price if less than 2500 miles were driven, 25 percent if more than 2500 to 17,999 miles were driven and

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[1] Paying the charge entitles the driver to drive in and out of the zone any number of times throughout the day. A fine of £60 to £120 is imposed for nonpayment.

[2] Exemptions to the charge include taxis, motorcycles, pedal cycles, busses, emergency service vehicles, those holding a disabled person's badge and some alternative fuels vehicles. Residents of the zone are entitled to a 90 percent discount.

[3] http://www.tfl.gov.uk/assets/downloads/corporate/congestion-charge-factsheet-july-2009.pdf

15 percent if more than 18,000 miles were driven. This system did not provide incentives to employers to choose environmentally friendly cars. Instead it encouraged drivers to drive more in order to exceed 2500 or 18000 miles, leading to increased emissions and congestion. The Company car tax was reformed in 2002. The percentage of list price taken as the taxable value of the car is now dependant on the emissions of the vehicle, i.e. lower percentage for low emission cars. The rates of the company car tax from 2009 are given in Table A3.7.

Table A3.7: Company Car Tax Rates (2009-2012)

Percentage of List Price taken as Taxable Benefit		CO_2 Emissions (g/km)		
Petrol Car (percent)	**Diesel Car (percent)**	**2009-10**	**2010-2011**	**2011-2012**
10	13	120	120	120
15	18	135	130	125
16	19	140	135	130
17	20	145	140	135
18	24	150	145	140
19	22	155	150	145
20	23	160	155	150
21	24	165	160	155
22	25	170	165	160
23	26	175	170	165
24	27	180	175	170
25	28	185	180	175
26	29	190	185	180
27	30	195	190	185
28	31	200	195	190
29	32	205	200	195
30	33	210	205	200
31	34	215	210	205
32	35	220	215	210
33	35	225	220	215
34	35	230	225	220
35	35	235	230	225

Source:http://cdn.volkswagen.co.uk/assets/common/content/fleet/VW_Company_Car_Tax.pdf

As diesel emissions are higher, the taxable value for diesel cars for most categories is 3 percentage points higher than petrol cars[1].

II. Revenue

HMRC (2006) estimates that the reform has lead to overall losses in revenues from income tax and NICs. These losses are estimated to be around £40 million for 2002-03, £135 million for 2003-04, £145 million for 2004-05 and £120 million for 2005-06. The reason for this is that employers are now choosing cars with lower emissions or have stopped giving the company car benefit.

III. Impact

As study by (HMRC, 2006) indicates that the tax has significant impacts as highlighted below:

- The number of company cars has reduced from 1.6 million in 2001 to 2.1 million in 2005.
- CO_2 emissions from cars have reduced by around 0.2-0.3 MtC for 2005 and are estimated to reduce by 0.35-0.65 MtC by 2010. Also, average CO_2 emissions were around 15 g/km lower in 2004 than would have been without the reforms.
- Percentage of company cars running on diesel increased from 33 percent in 2002 to 50-60 percent in 2004.
- The number of company car drivers receiving free fuel has reduced by around 600,000 since 1997. The proportion of company car drivers receiving free employer provided fuel for private use has also decreased significantly from around 57 percent in 1997 to around 30 percent in 2006.

b. Taxes on Waste and Natural Resources

(i) Landfill Tax

(a) Structure

The landfill tax was introduced in October 1996. Its aim is to reduce the externalities associated with waste disposal. These externalities include methane emissions, risk of contamination of water systems, disutility to local residents, health effects, etc. The incidence of the tax falls on the landfill site owners. This is passed onto the consumers via higher prices. The changes in the landfill tax rate since 1996 is given in Table A3.8.

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[1] This increase does apply if the car meets Euro IV emissions standards and is registered before 1st January 2006. Cars using alternative fuels are taxed at a discounted rate. Along with company cars, there is also a tax on employer provided fuel for private use. The charge for fuel is given by the percentage calculated in the above table multiplied by £16,900.

Table A3.8: Landfill Tax Rates

Date of Change	Standard Rate (£ per tonne)	Lower Rate (£ per tonne)
01.10.96	7	2
01.04.99	10	2
01.04.00	11	2
01.04.01	12	2
01.04.02	13	2
01.04.03	14	2
01.04.04	15	2
01.04.05	18	2
01.04.06	21	2
01.04.07	24	2
01.04.08	32	2.5
01.04.09	40	2.5

Source: https://www.uktradeinfo.com/index.cfm?task=bulllandfill

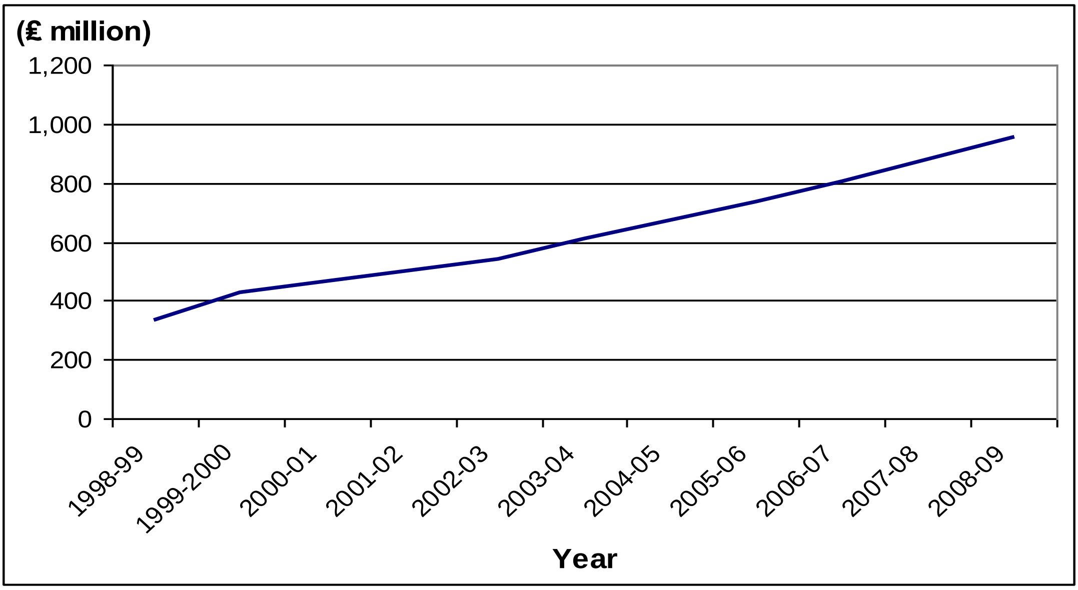
The landfill tax is set at two rates – a standard rate for active wastes and a lower rate for inactive or inert wastes[1]. Simultaneously the Landfill Tax Credit Scheme (LTCS) was also introduced. Under this scheme, landfill site owners can donate to approve bodies undertaking approved local community environment projects and in return receive a credit of 90 percent of the value of their donation from their landfill tax bill, up to a fixed limit. This limit, which was initially 20 percent of total liability, was reduced to 6 percent in 2003. Another change made in 2003 was that two thirds of the funds raised was diverted away from local community environment projects and allotted to public spending to encourage sustainable waste management.

(b) Revenue

The revenue from the landfill tax till 2009 is shown in the Chart A3.12.

[1] Inactive wastes are those that cause less damage to the environment such as rocks and soil, ceramic materials, minerals, ash and water. Initially, the standard rate was £7 per tonne and the reduced rate £2 tonne. The standard rate was increased to £10 per tonne in 1999 and a landfill tax escalator of £1 was introduced. This meant that the standard rate would be increased by £1 each year. The escalator was increased to £3 in 2005 and to £8 in 2007. In 2008, the lower rate was also raised to £2.5.

Chart A3.12: Landfill Tax Revenue



Source: https://www.uktradeinfo.com/index.cfm?task=bulllandfill

From the Chart A3.12 a sharp increase in revenue in 1999-2000 is noticeable, which is mainly due to the increase in tax rates. This is followed by steady growth and rates (Table A3.8 and Chart A3.12)[1]. The landfill tax for 2008-09 is £954 million or 0.2 percent of the total tax revenues.

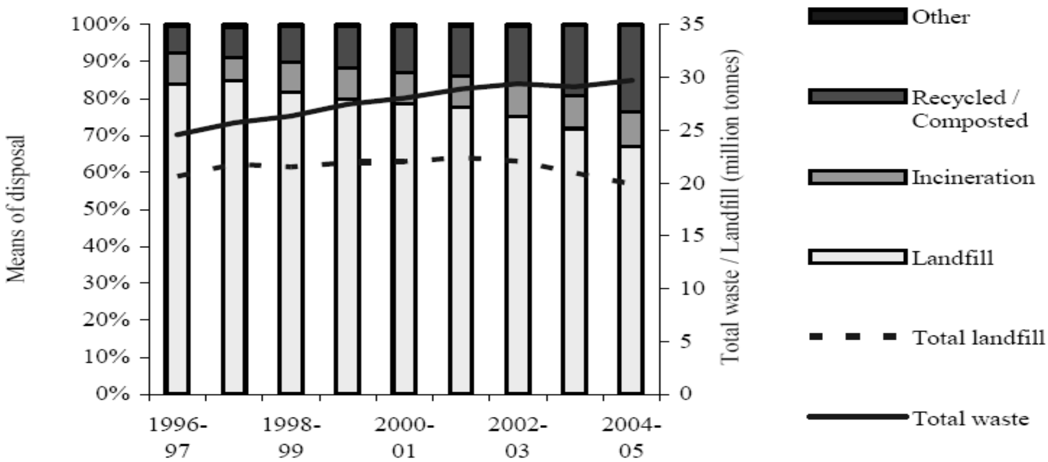
(c) Impact

Waste disposed into landfill sites has reduced from 86.9 million tonnes in 1998-99 to 52.5 million tonnes in 2008-09, a reduction of around 39 percent. The amount of active waste disposed reduced by 32 percent while inactive waste reduced by 74 percent.

The effectiveness of the tax can be seen from the following figure. Land filled waste has decreased in spite of increasing total waste over the years. The proportion of waste being recycled has increased (Chart A3.13).

[1] No sharp increase is noticed even after increase in the escalator in 2007.

Chart A3.13: Total Municipal Waste, Landfill and Other Means of Disposal



Source: Leicester (2006).

Investment in sustainable waste management from 2003 onwards has also had a positive effect. In England, approved planning decisions (i.e. where planning permission has been granted) for landfill sites fell by 14 percent between 2002-03 to 2003-04, while approved decisions for waste treatment sites rose by 52 percent and composting facilities increased by 55 percent (Seely, 2009a).

(ii) Aggregates Levy

(a) Structure

The aggregates levy was introduced in 2002. Aggregates refer to rock, gravel, sand and any materials naturally mixed with them. The tax is levied on quarry operators and other organizations that commercially exploit aggregates. Imported aggregates are also charged when they are commercially exploited. This tax is charged to take account of the external costs of aggregates extraction. These externalities include emissions from transportation, noise, dust, pollution of groundwater, loss of habitat for wildlife, etc. The changes in the aggregates levy rate since 2002 are given Table A3.9.

Table A3.9: Aggregates Levy Rates: 2002-09

Date of Change	Standard Rate(£ per tonne)
01.04.02	1.60
01.04.08	1.95
01.04.09	2.00

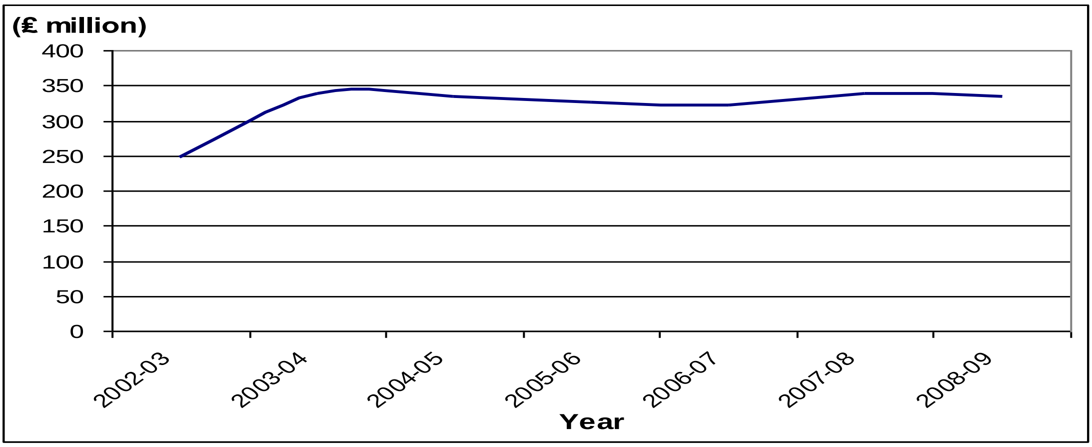
Source: https://www.uktradeinfo.com/index.cfm?task=bullaggr&hasFlashPlayer=true

The rate remained £1.60 till 2008. Since then it was increased twice to account for inflation. The rate is currently £2 per tonne of aggregate with certain exemptions[1]. An Aggregates Levy Sustainability Fund (ALSF) was also established. A part of the revenue from the levy goes to this fund to be used to minimize the demand for aggregates, promote environmentally friendly aggregates extraction and reduce the local effects of extraction. This fund will remain till 2011 and £35 million per year (which is around 10 percent of the aggregates levy revenue) is set aside for it.

(b) Revenue

The revenue from the Aggregates levy has been more or less stable over the last few years is shown Chart A3.14.

Chart A3.14: Aggregate Tax Revenue



Source: https://www.uktradeinfo.com/index.cfm?task=bullaggr&hasFlashPlayer=true

[1] Exemptions from the tax include coal, clay, shale, slate, metals, metal ores, gemstones, semi precious stones and industrial minerals. Other exemptions are based on what use the aggregate is put to. Tax on exported aggregates is refunded.

There is a special rate for Northern Ireland. This is because it was felt that Northern Ireland would be placed at a greater risk from international competition due to the land boundary it shares with the Republic of Ireland. As long as the aggregate is both extracted and exploited in Northern Ireland, the levy is subject to an 80 percent discount, leaving the rate at 32p per tonne. This discount will be available to Northern Ireland's Quarry operators as till 2011 provided they sign up for certain environmental improvements.

The revenue for 2008-09 is ₤334 million or 0.07 percent of the total tax revenues for that year.

(c) Impact

The total amount of aggregates extracted fell from 266.5 million tonnes in 2003-04 to 224.4 million tonnes in 2008-09, a fall of around 15 percent. In 2008-09, 33.1 million tonnes were relieved of taxation as they were exported and 21.9 million tonnes were exempted. This fall in aggregate extraction is due to both the aggregates levy and the landfill tax. While the former raised extraction costs, the latter increased waste disposal costs and therefore encouraged the reuse of hard core and other inert wastes instead of virgin aggregates in road building, etc. Also, the sales of aggregates fell by 8 percent between 2001 and 2003 in spite of increasing construction activity. However, this could have been due to factors other than the aggregates levy and the landfill tax. During the same period estimated production of recycled aggregates in England increased by 3.1 million tonnes.

(iii) Water Abstraction Charge

Water abstraction charges are levied by the Environment Agency to cover the costs they incur in water resource management. It is levied on businesses that extract and use over ground, underground or tidal water sources. It is charged on the amount of water licensed to be abstracted. Although it is not explicitly considered an environmental tax, it does affect the decision of a firm to abstract water or not and how much to extract.

The abstraction charge includes three charges, viz., application charge - ₤135, advertising administration charge - ₤100 and annual subsistence charge – minimum ₤25. The first two are fixed charges. The subsistence charge depends on the region where water is abstracted, the source, the time of year and the amount of water lost[1]. These are shown in Table A3.10. The other factors are given in Table A3.11. The subsistence charge cannot be less than ₤25.

[1] It is calculated by multiplying the volume of water abstracted by the Standard Unit Charge (SUC), the Environment Improvement Unit Charge (EIUC), the source factor, season factor and loss factor. The SUC is a charge for the region from which water is abstracted. The EIUC is a charge to recover the cost of compensation payments.

Table A3.10: SUC and EIUC - 2009

Region	SUC ($£/1,000m^3$)	EIUC - Non Water Companies ($£/1,000m^3$)	EIUC - Water Companies ($£/1,000m^3$)
Anglian	26.08	2.07	2.07
Midlands	14.88	0.99	0.99
Northunbria	25.62	0	0
North West	13.22	0.76	1.46
Southern	18.75	1.9	1.9
South West/Wessex	19.71	2.57	1.46
Thames	13.84	0.83	1.24
Yorkshire	11.46	0.61	0
Environmental Agency Wales	13.68	1.15	0

Source: http://www.environment-agency.gov.uk/business/regulation/38809.aspx

Table A3.11: Source, Season and Loss Factors - 2009

Source factor	Unsupported	1
	Supported	3
	Tidal	0.2
Season factor	Summer	1.6
	Winter	0.16
	Whole year	1
Loss factor	High (e.g. spray irrigation)	1
	Medium (e.g. private and public water supply)	0.6
	Low (e.g. mineral washing)	0.03
	Very low (e.g. power generation, fish farms, water meadows)	0.003

Source: Leicester (2006).

c. Taxes on Energy

(i) Climate Change Levy

(a) Structure

Climate Change Levy (CCL) was announced in the 1999 Budget and implemented in April 2002. It was announced earlier to give businesses time to adjust their practices. It is a tax on business use of energy. Its aim is to provide incentives for energy efficiency, reduced consumption and switching to low emission fuels that do not attract a tax.

The changes in the CCL till 2009 are given in Table A3.12.

Table A3.12: Climate Change Levy Rates - 2001-09

	Electricity (p/kWh)	Natural gas (p/kWh)	LPG (p/kg)	Solid fuels (p/kg)
Apr-01	0.43	0.15	0.96	1.17
Apr-07	0.441	0.154	0.985	1.201
Apr-09	0.47	0.164	1.05	1.1281

Source: Leicester (2006). http://customs.hmrc.gov.uk/channelsPortalWebApp/downloadFile?contentID=HMCE_PROD1_029570

The CCL is charged at different rates according to the type of fuel supplied and its energy content. Electricity is charged at a higher rate as losses through generation, transmission and distribution are high. The CCL rate has been increased twice, in 2007 and 2009, to account for inflation. A number of exemptions are also in the tax[1].These were also put in place to protect UK business competitiveness, including supplies of energy for exports and other purposes.[2] At the time as the CCL, the government also introduced three other schemes[3].

(b) Revenue

The revenue from the CCL is shown in Chart A3.15 from 2001.

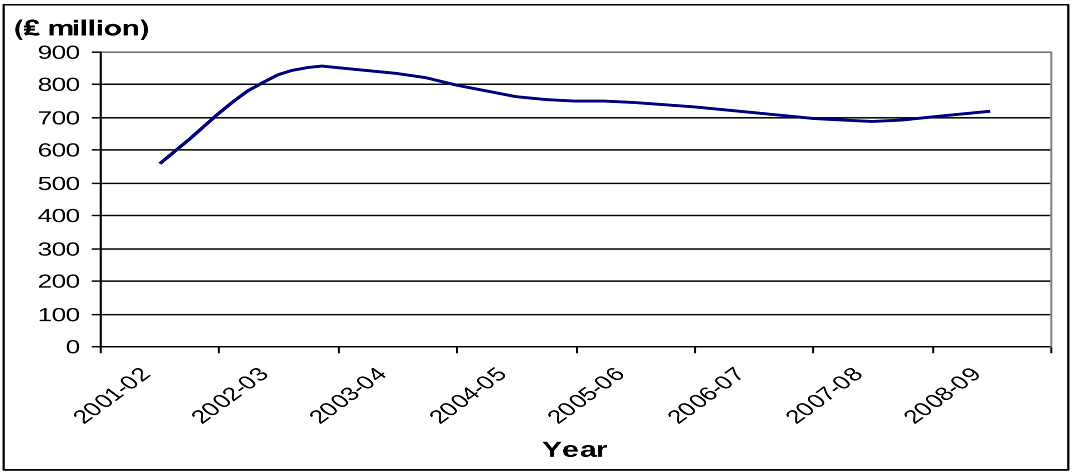
The revenues from the CCL peaked at ₤832 million in 2003-04 after which it declined. Revenue has started increasing again after 2007 probably due to the increase in the tax rates. Around three quarters of total revenue comes from the supply of electricity and a quarter from the supply of natural gas. Solid and other fuels generate very small revenues each year. Revenues from CCL have been recycled to the business sector by a reduction in employer's National Insurance contributions by 3 percentage points. This has shifted tax burden to energy and away from labour costs.

[1] These include, electricity generated from new renewable sources, electricity generated from coal mine methane, energy for good quality combined heat and power (CHP) stations and CHP generated electricity sold via the grid, natural gas in Northern Ireland (This is exempted as the market is very small and less polluting than alternatives such as coal and oil), fuel used in certain processes using recycled materials which compete with non-fuel use or dual use processes and waste solid fuels.

[2] these included use in manufacture of other energy products, for electricity generation (to avoid double taxation), non-fuel (for example, natural gas used as feedstock for certain chemicals) and dual use purposes (for example, coke as a chemical reductant for iron making), as these are not energy uses and use by some forms of transport (rail; other passenger transport; maritime voyages beyond territorial waters).

[3] These are Climate Change Agreements (CCA), Enhanced Capital Allowance (ECA) and the Carbon Trust. The CCA provides an 80 percent reduction in the CCL to energy intensive sectors in exchange for entering into agreements to meet energy efficiency targets. Under ECA, the government provides a 100 percent first year offset against profits for corporation tax for investments made in energy saving technologies by firms. The third scheme, the Carbon Trust, was established to provide an information and consultancy service on energy to all sectors of business and to be an effective mechanism for delivering investment in new and emerging technologies. It is funded from the revenues of the levy.

Chart A3.15: Revenue from Climate Change Levy



Source: www.hmrc.gov.**uk**/stats/**tax_receipts**/table1-2.pdf

(c) Impact

A study undertaken by Cambridge Econometrics in 2003 on the effects of the CCL has found that CCL reduces both business demands for energy and carbon emissions. Cambridge Econometrics estimated that CCL reduces overall energy demand in the economy by 0.2 percent in 2000, 1 percent in 2001, 1.8 percent in 2002 and 2.9 percent by 2010 compared with a situation where the CCL package had not been announced or implemented. Carbon emissions are reduced by an estimated 0.2 percent in 2000, 1 percent in 2001, 2 percent in 2002 and 2.3 percent in 2010. Also, due to the reduction in energy demand and the cut in National Insurance contributions, the CCL will also lead to a reduction in the costs for business. Cambridge Econometrics estimates a 0.13 percent reduction in overall unit cost for businesses by 2010.

Another effect of CCL is on combined heat and power stations (CHP). Cambridge Econometrics estimated that due to its exemption from CCL, good quality CHP will increase by 1.2 gigawatts of electricity (GWe) by 2010. The CCA has also proved to be effective in reducing emissions while also supporting competitiveness of energy intensive businesses. By 2010, it is estimated that CCAs will deliver savings of 2.8 MtC per year.

(ii) VAT on Domestic Fuel

The VAT is the major indirect tax in the UK. VAT is levied at three rates – a zero rate (0 percent), a reduced rate (5 percent) and a standard rate (15 percent till 31st December 2009; 17.5 percent after 1st January 2010)[1]. Before 1993, VAT on domestic fuel like gas and electricity was zero rated. This reduced the price of domestic fuel relative to other goods and increased its demand. Domestic fuel is now charged at the reduced rate of 5 percent. Although this is not considered an environmental tax, increasing the tax rate on domestic fuels does have positive environmental implications. Transport fuel is charged at the standard rate.

The amount of revenue generated by the VAT on domestic fuel is not clear. It has been estimated that each percentage point of VAT on fuel raises around ₤160 million. Therefore, the 5 percent rate on domestic fuel must raise around ₤800 million per year. (Leicester, 2006)

The main disadvantage of this tax is that the rate is the same across for all fuels and so it does not provide incentives to use more environmentally friendly fuels. Another problem is that VAT on fuel is regressive. It will therefore, led to an increase in fuel poverty in the UK, i.e. it increases the number of households who spend more than 10 percent of their income on heating their house.

3.3 Eco Taxes in Germany

a. Ecological Tax Reform

(i) Objectives

The objective of German ETR is to raise energy taxes so that prices reflect the true economic cost of energy use (i.e., internalize the externalities) and use the revenue to promote employment by reducing the cost of labor. Germany undertook Ecological Tax Reform between 1999 and 2003. Through this reform, Germany expected to raise revenue of 30 million DM annually.

(ii) Components of the Ecological Tax Reform

The Ecological Tax Reform in Germany comprises of (a) raising energy tax, and (b) introduction of tax on electricity.

(iii) Design of the Ecological Tax Reform

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[1] http://www.hmrc.gov.uk/vat/forms-rates/rates/rates-thresholds.htm#8

Since April 1999 and over the course of the ecological tax reform, the tax rate on mineral oil for fuel, gas and heating oil has been increased and an electricity tax introduced:

- The tax rates on mineral oil for fuel (gasoline and diesel) were increased in five steps between 1999 and 2003 by 3.07 Cent per litre each year, i.e. by a total of 15.37 cent per litre compared with 1998.
- The tax on mineral oil for light heating oil increased by 2.05 Cent per litre in 1999.
- The tax on mineral oil was increased in 1999 for natural gas by 0.164 Cent per kWh for liquid gas by 12.78 Euro for every 1 000 kg; in 2003 the tax rate for natural gas was increased by a further 0.2 Cent per kWh and by 22.26 Euro for every 1 000 kg for liquid gas.
- Starting in 1999, an energy tax of 1.02 Cent per kWh was introduced. The tax rate increased until 2003 by 0.26 Cent per kWh yearly to reach a current 2.05 Cent per kWh.
- From 2000 on, the tax rate on mineral oil for heavy fuel oil for heat and electricity production was fused to a uniform mineral oil tax rate of 17.89 Euro per 1000 kg. This rate has been increased since 2003 and now reaches 25 Euro per 1000 kg.
- Brown coal and hard coal, as well as fuels produced therewith, are not comprised in the ecological tax reform and have been exempt of energy tax to date.

These rates are presented below in Table A3.13.

Table A3.13: Rates of Eco Taxes in Germany

Energy Source	**Unit**	**Tax Rate Before April 1999**	**Tax Increase (Eco-tax)**		
		DM Per Unit	DM Per Unit	DM/GJ	Dm/Ton CO_2
Coal	tonne	0.00	0.00	0.00	0.00
Heavy Fuel Oil (heating)	tonne	30.00	0.00	0.00	0.00
Heavy Fuel Oil (electricity)	tonne	55.00	0.00	0.00	0.00
Natural Gas	MWh	3.60	3.20	0.89	15.87
Electricity (Final Energy)	MWh	0.00	20.00	5.56	-
Electricity (Primary Energy)[1]	MWh	0.00	20.00	2.11	35.71
Heating Oil	1000 Liter	80.00	40.00	1.12	15.19
Diesel Fuel	1000 Liter	620.00	60.00	1.68	22.66
Gasoline, Unlead	1000 Liter	980.00	60.00	1.85	25.75

[1]. Average efficiency (38 percent) and CO2 emmissions (0.56kg per kwh)

Source: Economic Studies Program Series – Kolhaas (2000).

Derogations were introduced to accelerate the development and introduction on the market of certain environmentally-friendly and energy-saving technologies:

- Highly efficient combined heat and power plants (cogeneration and use of electricity and heat) with a minimum utilization rate of 70 percent are exempt from the mineral oil tax and the ecological tax; with a rate of 60 percent, they are only exempt from the ecological tax.
- Gas-steam power plants are exempted from the mineral oil tax and the eco-tax for five years after first generation.
- Electricity from renewable sources meant for the use of the producer is exempt from the electricity tax. Electricity consumption in the framework of contracting is also exempt from taxes.
- Fuel with a sulphur content over 10 ppm are taxed with an additional 1, 53 Cent per litre.
- Local public transport systems pay a reduced mineral oil tax rate of 60,048 Cent/litre for petrol, 41,538 Cent/litre for Diesel, 16,695 Cent/kg for liquid gas and 1, 38 Cent/kWh for natural gas.
- The public track and rail system enjoy a reduced electricity tax amounting to 56 percent of the regular tax rate (1,142 Cent/kWh).
- A reduced tax rate applies for natural gas until 2020, and for liquid and natural gas until 2009 when used as fuel (9 Cent/litre).
- Biofuels are exempt until 2009 from both the mineral oil tax and the eco-tax.

Sectoral Price Effects for Manufacturing Branches in Germany are presented in Table A3.14.

Table A3.14: Sectoral Price Effects for Manufacturing Branches

(in percent)

Manufacturing Branches	Energy Tax 2.00 DM/GJ	Compensation (Revenue Neutral)	Net Effect
Iron and steel	5.1	-0.7	4.4
Chemical products, nuclear and fissile materials	2.1	-0.5	1.6
Non-ferrous metals, non-ferrous semi-finished products	1.7	-0.5	1.2
Quarrying	1.9	-0.7	1.2
Agricultural products	1.4	-0.7	0.6
Cold rolling mills, etc.	1.4	-0.8	0.6
Foodstuffs (excluding beverages)	1.0	-0.6	0.5
Textiles	1.0	-0.6	0.4
Other transport services	1.0	-0.6	0.4
Plastic products	0.9	-0.6	0.3
Market-related services in the catering industry and hotels	0.8	-0.5	0.3
Iron, sheet metal and metal products	0.9	-0.7	0.2
Retail services	0.7	-0.6	0.1
Printing and copying services	0.7	-0.6	0.0
Building and housing services	0.2	-0.2	0.0
Road vehicles	0.6	-0.6	0.0
Wooden goods	0.7	-0.7	0.0
Other market-related services	0.3	-0.3	0.0
Services provided by science, culture and publishing	0.4	-0.5	0.0
Building construction and civil engineering	0.8	-0.8	-0.1
Market-related services provided by the health and veterinary system	0.3	-0.4	-0.1
Development services	0.5	-0.6	-0.1
Electro technical products	0.5	-0.7	-0.2
Engineering products	0.6	-0.8	-0.2
Wholesale services and similar, recycling	0.4	-0.6	-0.3
Insurance services	0.3	-0.6	-0.3
Social insurance services	0.5	-0.8	-0.3
Service provided by private organisations, domestic services	0.4	-1.1	-0.7
Postal services and telecommunications	0.2	-0.9	-0.7
Government services	0.5	-1.2	-0.7

Source: Federal Statistical Office; DIW input/output analysis; DIW calculations.

(iv) Use of the Ecological Tax Reform Revenue

The ecological tax's revenue was primarily used to reduce non-wage labour costs put towards public pension scheme or to limit their increase. In 2003, the revenue generated by the eco-tax amounted to approximately 18.7 billion Euro, from which 16.1 billion, i.e. about 90 percent, went into the public pension scheme. Employers and employees could thus benefit from a reduced contribution rate, from 20.3 percent in 1998 to 19.5 percent in 2005. The relief offered by the ecological tax reform is however larger: without the ecological tax reform, contributions to the public pension scheme would have further increased in the same time-period as a result of demographic and economic pressures. Without the ecological tax reform, contributions in 2005 would thus have been at least 1.7 percent points higher, i.e. at 21.2 percent.

Table A3.15: Development of the rate of contribution to social insurances in Germany (in percent of wage costs)

Year	Pension Fund	Insurance			Total
		Health	Unemployment	Nursing/Care	
1995	18.6	13.2	6.5	1.0	39.3
1996	19.2	13.4	6.5	1.7	40.8
1997	20.3	13.3	6.5	1.7	41.8
1998	20.3	13.6	6.5	1.7	42.1
1999	20.3 (until March)	13.5	6.5	1.7	42.0
1999	19.5 (April)	13.5	6.5	1.7	41.2
2000	19.3	13.5	6.5	1.7	41.0
2001	19.1	13.5	6.5	1.7	40.8
2002	19.1	14	6.5	1.7	41.3
2003	19.5	14.4	6.5	1.7	42.1
2004	19.5	14.3	6.5	1.7	42.0
2005	19.5	14.2	6.5	1.7	41.9
2006	19.5	13.3	6.5	1.7	41.0
2007	19.9	14.2	4.2	1.7	40.0
2008	19.9	14.8	3.3	1.7	39.7

Source: Times Series of Social Security Contributions at www.deutsche-rentenversicherung.de

b. Packaging Ordinance

In January 2003 Germany introduced a compulsory deposit on non-recyclable drinks packaging. The compulsory deposit is payable on all non-ecologically favourable and non-recyclable drinks packaging between 0.1 to 3 litres in volume containing mineral water, beer, soft drinks and alcoholic mixed drinks. The deposit has stabilised the proportion of recyclable drinks packaging and put an end to the throw-away mentality.

The compulsory charge is 25 cents. Fruit and vegetable juices, milk and wine, as well as ecologically favourable non-recyclable drinks packaging – such as cartons, polyethylene bags and stand-up bags – are deposit-free. In Germany, glass, paper, old clothes, compost and bio-waste, packaging, metal, bulky waste and specialist waste are collected separately by private households before they are recycled by public-sector or private-sector disposal agencies (Table A3.16).

Table A3.16: Recovery Quotas of Waste Packaging: 1991-2006

(percent)

Material	1991	2001	2002	2003	2004	2005	2006
Glass	53.7	85.1	86.2	85.9	81.5	82.6	82.4
Aluminium	16.6	75.3	73.1	71.2	72.9	76.2	76.6
Tinplate	37.1	75.7	77.2	81	81.7	83.8	90.2
Plastics	11.6	51.8	50.3	55	48.8	47.6	55.7
Paper	55.8	91.9	88.8	88.1	91	91.1	89.4
Liquid Containers	0.0	62.8	63.4	62.2	62.5	62.4	66.4
Total Quotas	**39.2**	**79.3**	**77.9**	**78.1**	**78.4**	**78.5**	**78.8**

Source: Federal Statistical Office (2008), Federal Environment Agency (UBA), Federal Environment Ministry (BMU)

c. Vehicle Tax

Effective 1 July 2009, after a lengthy reform process, Germany introduced a new method to calculate annual taxes on new cars. The new system combines the previous taxation based on cylinder capacity (although now at a lower rate) and a CO_2 component, which charges a tax of EUR 2 per gram of CO_2 emissions per kilometre (g/km) if those exceed a threshold of 120 g/km. Under the new tax scheme, cars with higher cylinder capacity or fuel consumption are taxed higher than under the previous tax scheme: A petrol-powered car in the mini segment with low fuel consumption (i.e., CO_2 emissions of less than 120 g/km) is subject to an annual tax of approximately EUR 20 only, while a luxury car with a relatively high cylinder capacity and fuel consumption is subject to charges between approximately EUR 300 and EUR 400.24 The differences in taxation on these two vehicle segments have approximately doubled compared to the previous tax scheme. The change is less substantial in the case of diesel cars because of the higher tax rate on cylinder capacity (to compensate for the lower energy tax on diesel fuel).

(i) Objective

This reform of car taxation has the sole aim of reducing CO2 emissions from road traffic. Therefore, the question arises if this tax scheme is able to influence the purchase decisions with respect to new cars, given that incentives can arise on the basis of the total amount of tax and on the basis of the tax differential between vehicles.

The revenue from car taxes currently amounts to almost EUR 8 billion (the total taxes on road vehicles amount to approximately EUR 8.8 billion), at an average tax of EUR 200 per car. Also, the tax on vehicles registered prior to 1 July 2009, which are not subject to the new tax rules, varies substantially depending on the engine type (petrol/diesel), cylinder capacity and European emission standard.

In this reform, it was decided to maintain the annual tax revenue constant. Under the new system, the approximately three million new registrations per year are subject to annual taxes of EUR 120 on an average petrol-powered vehicle, and EUR 300 on an average diesel-powered vehicle. Notwithstanding the larger difference in the amounts of tax paid, the lack of monetary significance of car taxes might prevent a considerable incentive to buy fuel efficient cars. Depending on the vehicle, the share of annual taxes in total car levies ranges between less than 10 percent and 15 percent for petrol-powered cars and between 15 percent and 25 percent for diesel-powered cars. In relation to total costs of cars, the road tax accounts for between 1 percent and 5 percent. In other words, the absolute amount of tax remains small compared to the total costs for the ownership and use of vehicles. Germany is one of the European countries with the lowest tax differential across car segments. Further, the share of CO_2 based taxes in the total tax burden is relatively small.

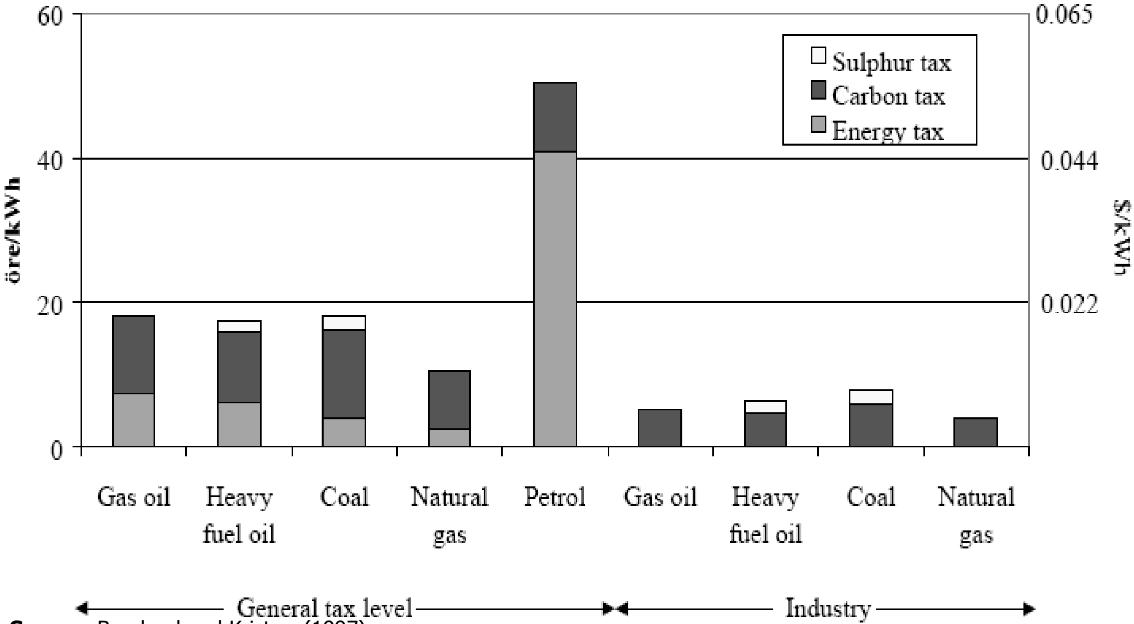
3.4 Eco Tax in Sweden

a. Carbon Tax

(a) Structure

Carbon tax was introduced in Sweden in 1991 which is levied on oil, coal, natural gas, and liquefied petroleum gas, petrol and aviation fuel in domestic traffic. The carbon rate was €27 per metric ton of CO_2 in 1991and now in 2009 the rate is €108/ton (Branlund and Kristrm ,1997).

Chart A3.16: Energy, Carbon and Sulphur Taxes in Sweden



Source: Branlund and Kristrm (1997)

(b) Impact

The most obvious effect of the carbon tax has been the expansion of biomass use in the system. The Use of Biomass has been increased in industry since 1990 from 45TWh/yr to 54TWh/yr. The most important result of the taxation system is the development of methods of biomass extraction and a biomass market and increase in the biomass demand.

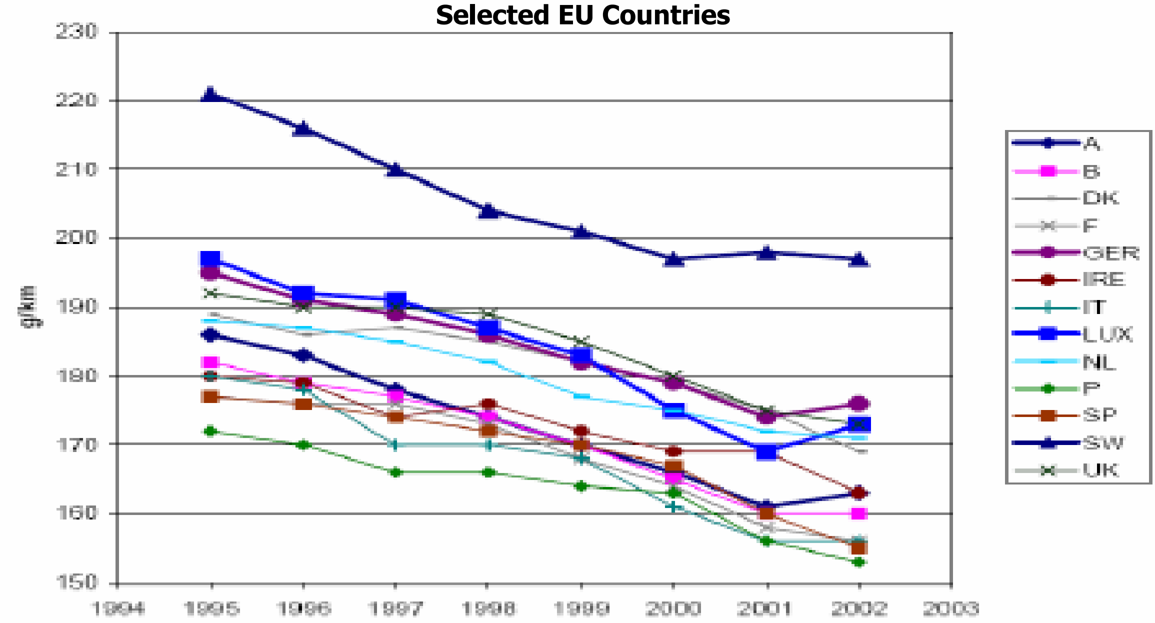
The total effect of the 1991 tax reform on industry was reduced tax levels, for some fuels by more than 50 percent. The energy tax on fossil fuels, are high and it acts as a powerful complement to the carbon tax. There are some differences in the carbon tax level among sectors and it leads to some effect on the behaviour of companies. Due to the design of tax system, the tax difference between fuels used in district heating systems and fuels used in industry has been reduced in 2000 when compared between 1993 and 1997.However, among the European countries Sweden, who produce the least CO_2 (6.7 metric tons p.a. per inhabitant, as against the EU average 9.3 t).

b. Vehicle Excise Duty

(a) Structure

Vehicle Excise Duty was introduced in Sweden in 2006. Annual Excise duties have been based on the economic performance of vehicles. The duty is comprised of a base charge of 360 SKR plus a CO_2 charge of 15 SKR per gram of CO_2 exceeding 100 grams per kilometre (g/km)Sweden is a country with low taxes on acquisition of cars. Chart A3.17 shows the average CO2 emissions from cars in different EU countries. Emissions from cars in Sweden are considerably higher than other EU countries. For 2003 it was 198 g/km. The carbon dioxide emissions have been reduced in 2003 when compared to 1995.

Chart A3.17: The Development in Average CO_2 Emissions from Cars in Selected EU Countries



Source: Borup (2007).

(b) Major Impacts

The increase in the number of Green cars is the result of environmental vehicle duties and the establishment of the concept of green cars has been quite successful. The use of eco friendly car has been increased from 52 percent in 2003 to 66 percent in 2006. From July 2005 to 2006, the total share of more efficient cars increased from 2.9-12.8 percent .In April 2007, this figure increased to 14.3 percent with the amount of new cars with emissions less than 120 gCO_2/km increasing by a factor 3 from 2006. As a result, average

CO_2 emissions for new cars decreased from 198gCO_2/km in 2003 to 191 gCO_2/km in 2006.

Despite increasing uptake of cleaner vehicles there has been an upward trend in the purchase of heavier and more powerful vehicles with higher CO_2 emissions before the VED was implemented in 2006. Although the purchase of smaller vehicles has increased since the VED was implemented, new fuel efficient cars are proportionally less than the uptake of heavier larger cars in Sweden.

3.5 Eco Tax in Canada

In Canada, both the federal and the provincial governments share the responsibility of environmental policy. As such, environmental policy and tax rates differ among the provinces. Canada has not had much experience with environmental taxes. Fuel tax seems to be the most important eco tax.

a. Fuel Tax

Fuel in Canada is subject to the GST/HST, the federal excise tax, provincial taxes and provincial sales taxes. In addition to this British Columbia also levies a carbon tax. In 2007, taxes in Canada represented, on average, 32 percent of the pump price. These taxes are discussed below:

(i) Federal Tax on Fuel

The federal government charges three types of taxes on fuel. One is the royalty tax; a tax on companies that dig oil out of the ground. The federal royalty increases from 1 to 5 percent of gross revenue over the first six years of production or until the initial investment has been recovered. After that, the royalty is either 30 percent of the net cash flow or 5 percent of gross revenue, whichever is greater. The second tax charged by the federal government is the GST/HST. For the year 2009, the GST is 5 percent and the HST 13 percent.

On top the royalty and the GST/HST, the federal government also charges an excise tax on fuel. The federal excise tax rates for the year 2009 are given in Table A3.17.

Table A3.17: Federal Excise Tax Rates on Fuel

(Cents/litre)

Fuel	Tax Rate
Leaded gasoline	11
Leaded aviation gasoline	11
Unleaded gasoline	10
Unleaded aviation gasoline	10
Diesel fuel	4
Aviation fuel	4

Source: Canada Revenue Agency (2008)

The excise tax is higher for leaded fuels. Ethanol is exempted from excise tax. In the year 2004, the government collected \$0.02 billion from royalty taxes on fuel, \$1.59 billion from GST on fuel and \$4.95 billion from fuel excise tax[1].

(ii) Provincial Taxes on Fuel

Each province has a separate tax for fuel. Thus, the price of fuel is different in each province. An important provincial tax is the recently introduced carbon tax in British Columbia. This is discussed below:

(a) British Columbia's Carbon Tax

Introduced on 1st July 2008, British Columbia's carbon tax is North America's first revenue neutral carbon tax. This tax is levied on the purchase and use of fossil fuels such as gasoline, diesel, natural gas, heating fuel, propane, coal, etc. The tax is payable by all individuals and businesses who buy fuel in British Columbia and by producers and manufactures of fuel who use their own fuel in the production process.

The carbon tax rate is different for each fuel. It depends on the fuel's emission of CO_2 equivalent (CO_2e). CO_2e is the amount of carbon dioxide, methane and nitrous oxide released into the atmosphere, with the non carbon dioxide emission levels adjusted to a carbon dioxide equivalent basis[2]. The rates will be slowly increased in order to give individuals and businesses time to adapt to the tax. The tax rate for each fuel is given Table A3.18.

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[1] http://www.parl.gc.ca/information/library/PRBpubs/prb0525-e.pdf

[2] The rates per tonne of CO_2e for the years 2008-12 are: July 1, 2008 - \$10 per tonne of CO_2e emissions, July 1, 2009 - \$15 per tonne of CO_2e emissions, July 1, 2010 - \$20 per tonne of CO_2e emissions, July 1, 2011 - \$25 per tonne of CO_2e emissions and July 1, 2012 - \$30 per tonne of CO_2e emissions

Table A3.18: Carbon Tax Rates by Fuel

Details	Tax rate (Cents/litre)				
	2008	2009	2010	2011	2012
Liquid Fuel					
Gasoline	2.41	3.62	4.82	6.03	7.24
Diesel	2.76	4.14	5.52	6.89	8.27
Light fuel oil	2.76	4.14	5.52	6.89	8.27
Heavy fuel oil	3.11	4.67	6.22	7.78	9.33
Aviation gasoline	2.45	3.67	4.90	6.12	7.34
Jet fuel	2.62	3.93	5.25	6.56	7.87
Kerosene	2.56	3.84	5.12	6.40	7.68
Gaseous fuel					
Natural Gas	49.88	74.82	99.76	124.70	149.64
Propane	1.53	2.30	3.06	3.83	4.60
Butane	1.76	2.65	3.53	4.41	5.29
Ethane	0.98	1.46	1.95	2.44	2.93
Penthane	1.76	2.65	3.53	4.41	5.29
Coke oven gas	42.31	63.47	84.62	105.78	126.93
Still gas	51.22	76.83	102.44	128.05	153.66
Solid Fuels					
Coal - Canadian bituminous	20.79	31.18	41.58	51.97	62.36
Coal - Sub bituminous	17.72	26.58	35.44	44.30	53.15
Coal - US bituminous	24.39	36.58	48.78	60.97	73.16
Coke oven gas	24.87	37.30	49.74	62.17	74.60
Petroleum coke	3.67	5.51	7.34	9.18	11.01
Tires - Shredded	23.91	35.87	47.82	59.78	71.73
Tires - Whole	20.80	31.20	41.60	52.00	64.40

Source: British Columbia Government (2008)
http://www.rev.gov.bc.ca/documents_library/notices/British_Columbia_Carbon_Tax.pdf

However, the structure includes certain exemptions also[1].

The carbon tax is forecasted to generate an estimated $2.27 billion over the next three years. The carbon tax revenues for the year 2008-09 are estimated at $300 million.

[1] The following are exempt from the carbon tax:

- biofuels and renewable energy, such as biodiesel, ethanol, biomass, pulping liquor and wood
- fuel exported from British Columbia for use outside the province
- fuel purchased in British Columbia by commercial air services
- fuel purchased in British Columbia by commercial marine services
- fuel that is brought into the province in the supply tank of an aircraft or ship that is used in the operation of the aircraft or ship,
- fuel used as feedstock in the production of other products, such as petrochemicals or plastics,
- up to 182 litres of fuel brought into British Columbia in the supply tank of most motor vehicles, other than large commercial vehicles,
- certain fuel packaged and sold in small sealed containers,
- fuel purchased on reserve by First Nations purchasers who qualify as Indians or bands under section 87 of the Indian Act (Canada)
- fuel purchased by visiting forces and members of the Diplomatic and Consular Corps.

Since the carbon tax is designed to be revenue neutral, this revenue will be returned to the public through reductions in other taxes. This is achieved through the following:

- Cut the two lowest provincial personal income tax rate by 5 percent
- A reduction a reduction in the general corporate income tax rate from 12 to 11 percent
- A reduction in the small business corporate income tax rate from 4.5 to 3.5 percent
- Provide a Northern and Rural Homeowner benefit of up to $200 beginning in 2011
- Reduce school property taxes for farm land by 50 percent beginning in 2011

The carbon tax could adversely affect the poor. Table A3.19 shows the impact of a $30 per tonne carbon tax on different income groups.

Table A3.19: Impact of Carbon Tax on Household Income Groups in Canada

Details	Income Groups					
	Average All Groups	**Lowest Quintile**	**Second Quintile**	**Third Quintile**	**Fourth Quintile**	**Top Quintile**
Average Household Income (2005) $	68102	16686	34599	55302	81349	152572
Average Household Size	2.51	1.45	2.11	2.56	2.99	3.41
Carbon Tax ($30/tonne) *Impact*						
Direct Cost Per Family	266	96	184	259	341	450
Indirect Cost	513	185	355	499	658	868
Total Cost	779	281	539	758	1000	1318
Percent of Average Income (percent)	1.14	1.68	1.56	1.37	1.23	0.86
Per Person	310	194	255	296	334	386

Source: CUPE (2008)

From the Table A3.18, we see that though the absolute cost is lesser for lower quintiles, the impact of the carbon tax as a percentage of income is higher for these groups. To reduce the impact of the carbon tax on the poor, a Climate Action Tax Credit of $115.50 per adult and $34.50 per child was introduced. In all, it is estimated that individuals and businesses will receive tax reductions of $494 million which is $194 million more than the carbon tax revenue.

b. Vehicle tax

(i) Federal Excise Tax

There is a federal excise tax on fuel inefficient automobiles. This is based on the weighted average fuel consumption rating, which is calculated by combining 55 percent of the city fuel consumption rating with 45 percent of the highway fuel consumption rating. The rates for automobiles with a rating of 13 or more litres per 100 kms are given below:

- at least 13 but less than 14 litres per 100 km - $1,000
- at least 14 but less than 15 litres per 100 km - $2,000
- at least 15 but less than 16 litres per 100 km - $3,000
- 16 or more litres per 100 km - $4,000

(ii) Tax for Fuel Conservation, Ontario (TFFC)

The TFFC was introduced in 1989, after which it has been reformed many times. It is a flat tax on fuel inefficient vehicles in Ontario. It is levied on passenger vehicles using 6 litres or more gasoline or diesel per 100 km and on sports utility vehicles using 8 litres or more. The TFC rates according to the fuel use rating of a car are given in Table A3.19.

Table A3.19: Tax for Fuel Conservation Rates

Highway Fuel Use Ratings (Litres/100km)	Tax on New Passenger Vehicles	Tax on New Sport Utility Vehicles
under 6.0	$0	$0
6.0 to 7.9	$75	$0
8.0 to 8.9	$75	$75
9.0 to 9.4	$250	$200
9.5 to 12.0	$1,200	$400
12.1 to 15.0	$2,400	$800
15.1 to 18.0	$4,400	$1,600
over 18.0	$7,000	$3,200

Source: http://www.rev.gov.on.ca/en/guides/rst/pdf/513.pdf

3.6 Eco Taxes in New Zealand

a. Waste Levy

The levy aims to provide both an incentive to avoid waste, along with funding to help develop waste minimisation infrastructure, such as reprocessing facilities and collection systems. This spending will help to develop infrastructure for waste minimisation including reprocessing facilities and collection systems. It could also help to develop markets for compost and recyclables. The Waste Minimisation Act provides for a waste levy of $10 per tonne of waste disposed of at disposal facilities. This levy was introduced in July 2009.

Table A3.20: Road User Charges in New Zealand

Specific Tax-base	Tax Rate (€ per 1000 km.)
Usage of roads by diesel powered vehicles of:	
Type 1, with maximum gross weight 2 tonnes or less.	7.8738
Type 1, with maximum gross weight between 2 and 3 tonnes.	9.3036
Type 1, with maximum gross weight between 3 and 4 tonnes.	10.6135
Type 2, with maximum gross weight between 2 and 3 tonnes.	9.1933
Type 2, with maximum gross weight between 3 and 4 tonnes.	10.3017
Type 2, with maximum gross weight less than 2 tonnes.	7.8498
Type 6, with maximum gross weight between 2 and 3 tonnes.	9.0397
Type 6, with maximum gross weight between 3 and 4 tonnes.	9.8506
Type 6, with maximum gross weight less than 2 tonnes.	7.8162
Usage of roads by other vehicles, weighing more than 3.5 tonnes (by types)	
Type 1, with maximum gross weight between 4 and 5 tonnes.	13.3581
Type 1, with maximum gross weight between 5 and 6 tonnes.	17.1630
Type 1, with maximum gross weight between 6 and 7 tonnes.	22.4746
Type 1, with maximum gross weight between 7 and 8 tonnes.	29.8446
Type 2, with maximum gross weight between 10 and 11 tonnes.	53.3364
Type 2, with maximum gross weight between 11 and 12 tonnes.	68.6905
Type 2, with maximum gross weight between 12 and 13 tonnes.	87.9888
Type 2, with maximum gross weight between 13 and 14 tonnes.	111.9124
Type 2, with maximum gross weight between 4 and 5 tonnes.	12.6096
Type 2, with maximum gross weight between 5 and 6 tonnes.	15.6036
Type 2, with maximum gross weight between 6 and 7 tonnes.	19.5813
Type 2, with maximum gross weight between 7 and 8 tonnes.	24.9073
Type 2, with maximum gross weight between 8 and 9 tonnes.	31.9942
Type 2, with maximum gross weight between 9 and 10 tonnes.	41.2930
Type 6, with maximum gross weight between 10 and 11 tonnes.	27.6566
Type 6, with maximum gross weight between 11 and 12 tonnes.	32.3204
Type 6, with maximum gross weight between 12 and 13 tonnes.	37.8959
Type 6, with maximum gross weight between 13 and 14 tonnes.	44.5318
Type 6, with maximum gross weight between 14 and 15 tonnes.	52.4104
Type 6, with maximum gross weight between 15 and 16 tonnes.	61.7044
Type 6, with maximum gross weight between 16 and 17 tonnes.	72.6106
Type 6, with maximum gross weight between 17 and 18 tonnes.	85.3450
Type 6, with maximum gross weight between 18 and 19 tonnes.	100.1185
Type 6, with maximum gross weight between 19 and 20 tonnes.	117.1664
Type 6, with maximum gross weight between 20 and 21 tonnes.	136.7381
Type 6, with maximum gross weight between 21 and 22 tonnes.	159.0880
Type 6, with maximum gross weight between 4 and 5 tonnes.	11.5108
Type 6, with maximum gross weight between 5 and 6 tonnes.	13.3293
Type 6, with maximum gross weight between 6 and 7 tonnes.	15.3733
Type 6, with maximum gross weight between 7 and 8 tonnes.	17.7244
Type 6, with maximum gross weight between 8 and 9 tonnes.	20.4834
Type 6, with maximum gross weight between 9 and 10 tonnes.	23.7509

Source: OECD.

- Half of the levy funds will be distributed to territorial authorities, on a population basis, to help with implementing their waste minimisation and management plans.
- The other half of the levy, less administration costs, is available for funding waste minimisation projects.

b. Road User Charges

The charge is set at a rate which recovers the cost that heavy vehicles impose on the public road system. The money collected is used for maintenance and construction of the road system, traffic enforcement and safety programmes.

c. Fuel Excise Duty

Excise duty is a charge imposed by the government on certain products sourced from overseas and some products produced within New Zealand.

The following motor spirits are entitled for refund of the excise duty and the goods and services tax (GST) charged (a) fuel in an exempted vehicle, (b) fuel in a road user charges-licensed vehicle, (c) fuel in a commercial vessel, and (d) for commercial purposes other than as fuel in any motor vehicle, vessel, or aircraft.

Agricultural vehicles, some mobile machinery and commercial vehicles that don't travel on the road are exempt vehicles. The types of fuel eligible for a refund are motor spirits, CNG and LPG.

Table A3.21: Fuel Excise Duty in New Zealand

Fuels	Excise Rate
Motor spirit	45.524c per litre + 8c per gram of Pb (lead)
Methanol	30.2c per litre
Natural gas (when compressed by a natural gas fuelling facility for use as a motor vehicle fuel)	$3.17 per gigajoule
Liquefied petroleum gas	10.40c per litre

Source: http://www.treasury.govt.nz

The following fuel types are not eligible for a refund (i) any fuel used for a motor vehicle that's used principally in vehicle races, trials, or other sporting events, (ii) fuel used in recreational boats and pleasure craft, (iii) fuel that has already had excise duty refunded, and (iv) diesel.

(i) Revenue from Fuel Excise Duty and Road User Charges

In 2009-10 alone full hypothecation will provide an estimated extra $35 million above what would have been provided under the current funding commitments. This extra funding is projected to rise to an extra $600 million by the year 2016.The funds will be used for improving road and public transport.

d. Motor Vehicle License Fee

All the revenue collected goes to the public road system, to pay for road construction and maintenance, traffic enforcement, and road safety programmes.

Table A3.22: Motor Vehicle License Fee in New Zealand

Specific Tax-base	Tax Rate (€ Per Year)
The use of a commercial ambulance	23.9908
The use of a fire truck weighing less than 3500 kg	23.9908
The use of a fire truck weighing more than 3500 kg	23.9908
The use of a goods van/truck, weighing less than 3500 kg	23.9908
The use of a goods van/truck, weighing more than 3500 kg	23.9908
The use of a motorcycle with a motor larger than 60 ccm	14.8743
The use of a motorcycle with a motor smaller than 60 ccm	10.0761
The use of a non-commercial ambulance	23.9908
The use of a private car*	23.9908
The use of a taxi (car)	23.9908
The use of a trailer or caravan, weighing less than 3500 kg	14.8743
The use of a trailer or caravan, weighing more than 3500 kg	23.9908

Source: OECD.
Note: *excluding Goods and Service Tax and Accident Corporation Compensation.

e. Voluntary Initiatives

(i) Recycling

The New Zealand Packaging Accord is a voluntary initiative to cut down on wasteful packaging. Those signing it – the packaging & packaged goods industry, local and central government and the recycling operators – are voluntarily committing to doing what they can to reduce the proportion of packaging in our total waste stream.

The Accord is the base document from which each sector has developed five year action plans. The progress against these action plans is reported each year in the Annual Progress Report, the content of which is presented to all parties at the annual Progress Report Launch.

On 7th September 2009, The Packaging Council released the latest data about New Zealand's packaging production, consumption and recovery showing that New Zealanders recycled more than 428,000 tonnes of packaging last year. Since 2004 the total quantity of packaging recycled increased by 26 percent, whereas consumption of packaging increased at a much slower pace by 14 percent. On a per capita basis the quantity recycled by every New Zealander increased by from 83 kg to 100 kg.

Table A3.23: Recycling Compliance Status in 2008

Materials	**Production**	**Consumption**	**Collection**	**Collection as percent of Consumption**	**Packaging Accord Target (percent)**
	(Tonnes)				
Aluminum	9,095	6,505	4,810	74	65
Glass	133,779	229,151	147,201	64	55
Paper	313,100	326,300	228,500	70	70
Plastics	136,491	154,381	36,918	24	23
Steel	43,860	18,865	10,820	57	43
Total	**636,325**	**735,202**	**428,249**	**58**	

Source: Packaging Council of New Zealand.

(a) Major developments in recycling in 2008

- New Zealand packaging production has increased overall by 1.8 percent across all materials except plastics which declined by 4 percent;
- Consumption increased by 4 percent overall with the exception of steel which has declined;
- Recovery increased by 2 percent with all sectors reporting increased tonnages except for paper. This is a particularly encouraging result given significantly reduced demand for recovered materials. Collection of steel, aluminum and plastics has increased with the introduction of the Auckland Materials Recovery Facility.

New markets have opened since the start of the Accord with 50 percent glass recovered now being used for new applications such as filtration, aggregate, construction etc.

(ii) Product Stewardship

Product stewardship encourages people involved in the lifecycle of the product to reduce, reuse and recycle. When a product stewardship scheme is introduced anyone involved in the product life cycle such as producers, brand owners, importers, retailers and consumers accepts responsibility for its environmental effects. When the industry takes the responsibility for the product, the advantages are that the industry has the technical expertise, design knowledge, and understanding of the market to establish an effective scheme. With product stewardship, some or all of the environmental costs from a product (such as inefficient resource use or disposal costs) are included in the price (internalised).

3.7. Summary

International experience shows that extensive tax reforms have been applied in the area of green taxes in different sub-continents and countries of the world. Particularly in Europe, Canada, Australia and New Zealand, in the last three decades, these taxes have generally evolved gradually. Mostly there has been in a sequence in these taxes, which initially began with user charges. Largely the emphasis in such taxes is on energy and transport. Yet over the years new tax bases have been used. These included among others, waste end taxes (in Austria, Finland, France, Greece, Italy, Sweden, Norway and UK), packaging and related levy (in Italy and Germany), solvents (Denmark and Norway), PVC/ phthalates (Denmark) and annual car taxes differentiated according to environmental characteristics (Germany). In terms of source of revenue, for general budget or earmarked taxes, these taxes have been increasing in importance in central and eastern European countries. However, overall revenue potential over the decade 1996-2006 has been showing a declining trend for most of the OECD countries.

Among the countries discussed in detail by us, in UK, for instance, data indicate that in absolute terms, although eco tax revenue has increased, revenue as a percentage of total taxes and GDP has declined over the years. In the duration 1993-2008, in terms of total taxes, this revenue fell actually from around 9 percent to 7.8 percent. Among the three major categories of environmental taxes in UK, viz., transport taxes, resource taxes and energy taxes, the revenue significance of transport taxes, in particular fuel duty has been the highest and it is followed by the vehicle excise duty.

Among others, Germany is one of the European countries with the lowest tax differential across car segments and it has relatively smaller share of CO_2 based taxes in the total tax burden. German ETR aimed to raise energy taxes so that prices reflect the true economic cost of energy use (i.e., internalize the externalities) and use the revenue to promote employment by reducing the cost of labor. Ecological Tax Reform between 1999 and 2003 in Germany primarily used ecological tax's revenue to reduce non-wage labour costs put towards public pension scheme or to limit their increase. Evidence indicates that without the ecological tax reform, contributions in 2005 would thus have been at least 1.7 percent points higher, i.e. at 21.2 percent.

Significant feature of Sweden's experience with carbon tax has been expansion of biomass use in the system. The Use of Biomass has increased in industry since 1990 from 45TWh/yr to 54TWh/yr. The most important result of the taxation system is the development of methods of biomass extraction and a biomass market with increase in the biomass demand. Despite increasing uptake of cleaner vehicles there has been an upward trend in the purchase of heavier and more powerful vehicles with higher CO_2 emissions before the VED was implemented in Sweden in 2006. Although the purchase of smaller vehicles has increased since the VED was implemented, yet new fuel efficient cars are proportionally less than the uptake of heavier larger cars in Sweden.

In Canada, both the federal and the provincial governments share the responsibility of environmental policy and tax rates differ among the provinces. Canada has much less experience with environmental taxes and Fuel tax seems to be the most important eco tax.

In New Zealand significant positive impact of environmental taxes particularly waste levy and packaging accord has been to avoid waste, along with funding to help develop waste minimisation infrastructure, such as reprocessing facilities and collection systems. An interesting aspect of the New Zealand Packaging Accord is its voluntary initiative to cut down on wasteful packaging. Those signing it – the packaging and packaged goods industry, local and central government and the recycling operators – are voluntarily committing to doing what they can to reduce the proportion of packaging in the total waste stream. From the base document called as Accord, each sector has developed five year action plans. Since 2004 the total quantity of packaging recycled increased by 26 percent, whereas consumption of packaging increased at a much slower pace by 14 percent. On a per capita basis the quantity recycled by every New Zealander increased by from 83kg to 100kg. Thus, product stewardship encourages people involved in the lifecycle of the product to reduce, reuse and recycle such that producers, brand owners, importers, retailers and consumers accept responsibility for its environmental effects.

Appendix 4

POLLUTING INPUTS AND OUTPUTS IN INDIA: IDENTIFICATION AND EFFECTIVE TAX RATES

4.1 Introduction

A uniform rate of GST does not discriminate between polluting/non-polluting inputs or output. This may not be adequate for environmental protection. The policy makers have so far viewed the proposed tax regime as a tool of maximizing government revenues through simplified tax structures and (hopefully) through higher rate of compliance than before. The role of taxes in correcting (mainly environmental) externalities is ignored.[1] Allowing for this second scope of a tax system must compromise the uniform nature of the GST regime. The objective of this annexure is to identify, based on some current research, the most polluting industrial inputs and outputs within Indian states. Since the effects of such pollutants are mostly local (i.e. they are 'public bad' within the state), corrective actions must be taken by states themselves.[2] Moreover, different states are characterized by different industrial composition and hence different pollution patterns. The corrective policy, if any, should differ from one state to the other. This provides a rational for modifying the uniform GST regime across states.

4.2 Methodology

The first step is, then, to calculate industrial pollution loads for different sectors across the states. We follow the pioneering effort of Gupta (2000) in this regard. In India, state wise or nation wise measurements of annual pollution loads are not available. However, industrial pollution intensities, defined by the ratio of pollutant output to total manufacturing activity[3], are available in the World Bank IPPS (Industrial Pollution Projection System) database. However, there are some debates regarding the suitable choices of denominator as well as the numerator.

For example, denominator choices can be (a) suitable volume of output,[4] (b) shipment value, (c) value added, and (d) employment. In practice, pollution loads are

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[1] Baumol and Oates (1988).

[2] In India, environmental management is a state subject. This is true for natural resources as well as for ambient air and water quality and solid waste pollution.

[3] Analogous to, say, the input-output coefficients

[4] Output volume, although attractive at the first look, runs into problem since the measurement of units may be different in different industries.

estimated separately by multiplying the pollution intensities (available by industrial sector) by the value of output and number of persons employed in each industry. Hettige *et al* (1995) has shown that in the case of the US, the ranking of industrial sectors by their pollution load is almost identical, irrespective of whether the value of output or employment is used as the unit of measurement. The total value of output is judged superior to value added because the energy and materials inputs are critical in the determination of industrial pollution. On the other hand, lack of physical data on volume of output in several countries limit the application of this system and for cross country analysis.

The second major problem is to choose a suitable estimate of numerator. There is a difference between emission and pollution, and the effects of different pollutants on environment and human health are different (some pollutes the soil more than water, for example). The IPSS measurement uses different toxicity ratings for each industry.[1] The IPSS pollution intensities are based on US technology. One justification of working with them in Indian scenario is the fact that technologies do converge across countries. On a different level, the industrial classification system in vogue for US and India may not match. One must employ due caution in applying those indicators to other countries.

Gupta (2002) has also identified the Central Pollution Control Board (CPCB) notified 17 categories of polluting industries[2] and measured pollution load for them. However, only 16 categories are considered since Thermal Power Plants are not treated under IPSS as a separate category. Using the same methodology, Pandey (2005), has extended and updated Gupta's (2002) initial findings of state level pollutants. As an indicator of output, she has used data on value of output and number of persons employed. These have been obtained from Annual Survey of Industries (ASI), which uses National Industrial Classification (NIC).

4.3 Overview of the Industries

The CPCB notified 16 industries are mostly concentrated in seven states namely, Maharashtra, Gujarat, Uttar Pradesh, Tamil Nadu, Bihar, Andhra Pradesh and Madhya

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[1] Hettige *et al.* (1995)

[2] These sectors get more attention from the CPCB than the rest. These are a) Aluminum, b) Basic Drugs and pharmaceuticals, c) caustic Soda, d) Cement, e) Copper Smelting, f) Distillery, g) Dyes and dye intermediates, h) Fertilizer, i) Iron and Steel, j) Leather, k) Oil refineries, l) Pesticides, m) Petrochemicals, n) Paper and pulp, o) Sugar, p) Thermal Power plants and q) Zinc smelting. They are also important in terms of employment and output. (See http://cpcb.nic.in/17cat/17cat.html)

Pradesh. Together, these account for more than 70 percent of the total value of production of these industries in India. Among these states, while iron and steel industry dominates in Bihar (now Jharkhand) and Madhya Pradesh, oil refinery is largely concentrated in Maharashtra and Tamil Nadu; fertilizer in Gujarat, Maharashtra and Uttar Pradesh, sugar in Uttar Pradesh and Maharashtra, and the cement industry dominates in Madhya Pradesh and Andhra Pradesh.

In 1994, among the 16 most polluting industries in terms of both values of production and employment, the largest industry was iron and steel. The five largest industries contributing 74 percent of the total value of industrial production and nearly 67 percent of total employment in these industries were iron and steel, oil refinery, fertilizer, sugar, and cement. The estimates of industrial pollution load have been obtained using the industrial value of production and employment as a measure of industrial activity. Pollution loads are estimated according to the nature of pollutants (water, air, toxic and metal) and also by medium (air, water and land) for the toxic and metal pollutants.

The relative contribution of each industry to total pollution load at the all India level shows that the iron and steel industry is the highest polluting industry in terms of all four pollutants except air where it ranks second to cement. Iron and steel is the largest water polluting industry in India with 87.4 percent of the total pollution load. The pulp and paper and aluminum industries rank second and third respectively with their contribution to total water pollution load at 4.6 and 2.5 percent. Sugar and distillery industries rank fourth and fifth, respectively (Table A4.1).

The cement industry is the biggest air polluter emitting nearly 34 percent of the total air pollution load. Iron and steel stands second, emitting 32 percent, while oil refinery ranks third contributing 7.4 percent to the total industrial air pollution load.

The iron and steel industry is also the largest metal polluter accounting for more than 71 percent of the total metal pollution load. Aluminum industry is the second highest contributor (nearly 16 percent) to metal pollution. In the toxic pollution category also, iron and steel industry is the highest polluter contributing 39 percent of the total pollution load. The second most polluting industry in this category is leather with about 14 percent share in total toxic load. Iron and steel, leather, petrochemical and oil refinery industries together account for 70 percent of total toxic pollution load. The main implication of these results is that substantial reduction in total pollution loads can be achieved by focusing pollution control efforts in a limited number of industrial sectors.

Table A4.1: Ranking of Industrial Sectors by Estimated Pollution Load

(Tonnes)

A: By Output Volume

Sl. No.	ISIC Code	Industry	Water	Air	Toxic	Metal
1	3720	Aluminum	3	6	5	1
2	3720	Copper	6	8	9	2
3	3720	Zinc	8	10	11	3
4	3710	Iron and steel	1	1	1	4
5	3692	Cement	11	2	14	5
6	3530	Oil refinery	12	3	4	6
7	3522	Drugs	10	15	12	7
8	3513	Petrochemicals	13	7	2	8
9	3512	Fertiliser	4	9	3	9
10	3512	Pesticide	9	12	8	10
11	3511	Caustic soda	15	13	10	11
12	3411	Pulp and paper	2	4	6	12
13	3231	Leather	14	14	7	13
14	3211	Dyes and dye intermediate	16	16	16	14
15	3131	Distillery	7	11	15	15
16	3118	Sugar	5	5	13	16

B: By Employment

Sl. No.	ISIC Code	Industry	Water	Air	Toxic	Metal
1	3720	Aluminum	16	7	8	2
2	3720	Copper	9	10	11	4
3	3720	Zinc	12	13	13	5
4	3710	Iron and Steel	1	2	2	1
5	3692	Cement	11	1	15	11
6	3530	Oil refinery	13	5	5	10
7	3522	Drugs	8	16	12	14
8	3513	Petrochemicals	14	9	7	9
9	3512	Fertiliser	7	11	4	6
10	3512	Pesticide	10	15	9	8
11	3511	Caustic soda	5	6	1	3
12	3411	Pulp and paper	3	3	3	12
13	3231	Leather	2	14	6	7
14	3211	Dyes and dye intermediate	15	12	14	13
15	3131	Distillery	6	8	16	16
16	3118	Sugar	4	4	10	15

Source: Pandey (2005).

Except water pollution, the ranks of different industries either by output volume or by employment are highly correlated. Pandey (2005) posits that Indian industries are overstuffed vis-à-vis the US ones. Hence it is better to work with output based measurements of pollution load.

4.4 Major Polluting States

In toxic pollution, there are seven states that account for about 70 percent of the total toxic industrial pollution. Maharashtra, the largest contributor, accounts for about 15.9 percent of the total toxic pollution in the country followed by Gujarat at 15.5 percent and Tamil Nadu at 8.5 percent. Bihar is at the fourth place with a share of 8.4 percent followed by Uttar Pradesh with 7.3 percent of the total toxic pollution load. Madhya Pradesh and Orissa contribute 7.0 and 6.2 percent respectively to this category of pollution.

Sixty-eight percent of the total industrial metal pollution load in the country is contributed by six states. Bihar ranks first with a share at 15.1 percent followed by Maharashtra at 14.2 percent. 12.1 percent of the total metal pollution load is generated by Orissa. Madhya Pradesh contribution to this category of pollution is 12.1 percent followed by West Bengal at 7.4 percent. Uttar Pradesh with a metal pollution load of 6.6 percent of the total load ranks sixth.

The ranking of states in water pollution is somewhat similar to that of metal pollution. The four largest water polluting states are the same as in the case of metal pollution. Bihar with 17.1 percent of the load leads the group and is followed by Madhya Pradesh with 12.9 percent, Maharashtra with 12.5 percent and Orissa with 10.9 percent of the total water pollution load. Andhra Pradesh and West Bengal respectively have a share of 6.7 and 6.9 percent of the total water pollution load. Uttar Pradesh with a share of 5.5 percent of the total pollution load puts the cumulative share of these seven states at about 73 percent.

As in the case of toxic pollution, Maharashtra is the largest polluter of air with a share of 15 percent of the total industrial air pollution followed by Madhya Pradesh at 11.2 percent. Gujarat ranks third with a share of 9.3 and is followed by Andhra Pradesh and Bihar at 8.9 and 8.6 percent share, respectively. Tamil Nadu and Uttar Pradesh contribute 7.9 and 7.5 percent of air pollution load, respectively. Orissa with a share of 6.6 percent, takes the cumulative contribution of these eight states to 74.8 percent of total industrial air pollution load. From Table A4.2, top 5 states in each category are:

Water: Bihar, Maharashtra, Madhya Pradesh, Orissa, West Bengal.
Air: Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh, Bihar
Toxic: Maharashtra, Gujarat, Tamil Nadu, Bihar, Uttar Pradesh
Metal: Bihar, Maharashtra, Orissa, West Bengal, Uttar Pradesh

Table A4.2: Contribution of Select States to Industrial Pollution Load

(percent)

State	Water	Air	Toxic	Metal
Andhra Pradesh	7.0	8.9	5.8	5.8
Bihar	17.1	8.6	8.4	15.1
Gujarat	4.2	9.3	15.2	4.2
Karnataka	3.1	4.3	2.0	2.9
Madhya Pradesh	12.9	11.2	7.0	12.1
Maharashtra	12.5	15.0	15.9	14.2
Orissa	10.9	6.6	6.2	12.1
Punjab	5.1	2.7	2.8	4.0
Rajasthan	1.3	3.8	1.9	1.7
Tamil Nadu	4.5	7.9	8.5	4.1
Uttar Pradesh	5.5	7.5	7.3	6.6
West Bengal	6.9	7.3	5.4	7.4

Source: Pandey (2005).

Since we are concerned about the local effects of pollution, one should also take the population density of the states into consideration. A high density state (like West Bengal or Kerala) will face higher per capita burden of pollution and the policy should be stricter there.

4.5 Major Polluting Industries and their Pollution Load: Across States

Table A4.3 provides the distribution of polluting industries, as a whole, across some selected states. We take the output (in 1994-95 prices) as the indicator of scale. It is clear that polluting industries are most heavily concentrated in five states, namely, Maharashtra, Gujarat, Uttar Pradesh, Andhra Pradesh and Bihar (together, they account for almost 55 percent of production).

A comparison between Table A4.2 and A4.3 quickly reveals why one should be careful with the pollution control exercise based on distribution of polluting industries. For example, Bihar does not figure into the top 5 industry concentration, yet figures in the top 5 pollution load in all categories. Combining the elements of Table A4.2 and Table A4.1, we try to predict major pollutants for different states.

Table A4.3: Percent Distribution of CPCB Notified Polluting Industries

State	Percent of Polluting Output
Andhra Pradesh	7.0
Assam	1.2
Bihar (Jharkhand)	7.0
Delhi	0.4
Goa	0.02
Gujarat	12.6
Haryana	1.6
Karnataka	3.0
Kerala	0.7
Maharashtra	18.3
Orissa	4.8
Tamil Nadu	8.4
Uttar Pradesh	10.4
West Bengal	4.2

Source: Pandey (2005).

Table A4.4: Major Sources of Water Pollution: By State

States	Industries (Except Iron and Steel)
Andhra Pradesh	Pulp and Paper
Assam	NA
Bihar	NA
Goa(*)	Distilleries
Gujarat	Pulp and Paper
Haryana	Pulp and Paper
Karnataka	Pulp and paper
Kerala (*)	Aluminum, Fertilizer, Drugs and Pharmaceuticals
Maharashtra	NA
Orissa	NA
Rajasthan	NA
Tamil Nadu	Pulp and Paper
Uttar Pradesh	Pulp and Paper
West Bengal	NA

Note: * major pollutants, not Iron and Steel; NA: not available.

In all the states except Goa, iron and steel is the major water polluting industry in terms of contribution to the total water pollution load in the state (Table A4.4). In fact, in all the states excepting Goa and Kerala, iron and steel industry contributes more than

50 percent to the states' total water pollution load. However, in Goa, distillery industry which ranks fifth at the all India level in terms of its contribution to total pollution load, is the only water polluting industry. The pulp and paper industry is the second largest contributor (5 to 20 percent) to states' water pollution load in Andhra Pradesh, Haryana, Karnataka, Tamil Nadu, Gujarat and Uttar Pradesh. Aluminum, fertilizer and drugs and pharmaceuticals are the other major water polluting industries besides iron and steel in the state of Kerala.

In terms of discharge of toxic pollutants, the iron and steel industry is the largest contributor to states' total toxic pollution load in all states except Assam, Gujarat, Goa, Kerala, Rajasthan and Tamil Nadu. In this category, the petrochemical and fertiliser industries are major contributors in Gujarat, distilleries in Goa, the fertiliser and aluminum industries in Kerala, oil refinery in Assam, leather in Tamil Nadu and the fertilizer industry in Rajasthan (Table A4.5).

Table A4.5: Major Sources of Toxic Elements: By State

States	Industries (Except Iron and Steel)
Andhra Pradesh	NA
Assam(*)	Oil Refinery
Bihar	NA
Goa(*)	Distilleries
Gujarat(*)	Petrochemical and Fertiliser
Haryana	NA
Karnataka	NA
Kerala(*)	Aluminum, Fertilizer
Maharashtra	NA
Orissa	NA
Rajasthan(*)	Fertilizer
Tamil Nadu(*)	Leather
Uttar Pradesh	NA
West Bengal	NA

Note: * major pollutants, not Iron and Steel; NA: not available.

For metal pollutants, iron and steel is the largest polluting industry in all the states except Goa. The oil refinery industry contributes substantially to states' total toxic pollution load in Assam, the copper industry in Delhi, Maharashtra and Rajasthan, petro-chemicals in Gujarat, the aluminum industry in Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Uttar Pradesh and West Bengal and the leather industry in Tamil Nadu.

Table A4.6: Major Sources of Metal Pollutants: By States

States	Industries (Except Iron and Steel)
Andhra Pradesh	NA
Assam(*)	Oil Refinery
Bihar	NA
Delhi	Copper
Goa(*)	Distilleries
Gujarat	petrochemical
Haryana	NA
Karnataka	Aluminum
Kerala	Aluminum
Madhya Pradesh	Aluminum
Maharashtra	Copper, Aluminum
Orissa	Aluminum
Rajasthan	Aluminum
Tamil Nadu	Leather
Uttar Pradesh	Aluminum
West Bengal	Aluminum

Note: * major pollutants, not Iron and Steel; NA: not available.

For air pollutants, the iron and steel industry is again the major polluting industry in all states except Assam, Goa and Kerala. Oil refinery, paper and cement are the major air polluting industries in Assam. While distillery is the single most polluting industry in Goa, cement and aluminum are the major air polluting industries in Kerala. Cement is a major air polluting industry for the states of Andhra Pradesh, Assam, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Rajasthan and Tamil Nadu. Among other industries, the paper industry in Assam, Haryana and Karnataka; the oil refinery industry in Assam, Gujarat, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal; the aluminum industry in Kerala, Orissa, Uttar Pradesh and West Bengal; the copper industry in Delhi; petrochemicals in Gujarat; distillery in Jammu and Kashmir and the sugar industry in Uttar Pradesh.

Table A4.7: Major Sources of Air Pollutants: By States

States	Industries (Except Iron and Steel)
Andhra Pradesh	Cement
Assam(*)	Oil Refinery, Paper, Cement
Bihar	NA.
Delhi	Copper
Goa(*)	Distilleries
Gujarat	petrochemicals ,cement, oil refinery
Haryana	Cement, paper
Karnataka	Cement, paper
Kerala(*)	Aluminum, Cement
Madhya Pradesh	Cement
Maharashtra	Aluminum, oil refinery
Orissa	Aluminum
Rajasthan	Cement
Tamil Nadu	Oil refinery
Uttar Pradesh	Oil refinery, Aluminum, sugar
West Bengal	Oil refinery, Aluminum

Note: * major pollutants, not Iron and Steel; NA: not available.

4.6 Designing an Effluent Charge

An important aspect of designing an effluent charge is to determine the *right* rate of charge. Theoretical literature prescribes that the rate of charge should be set such that the marginal gains from the pollution reduced equals the marginal cost of reducing it (MBA=MCA). In other words, a rate of charge equal to the marginal pollution abatement cost at the socially optimum level of pollution will induce the polluter to reduce his/her pollution to the socially efficient level. However, given the practical difficulties in measuring the damage due to pollution[1] and also gains from reduction in pollution at the margin, the above approach is difficult to put in practice. Economists have suggested an alternative approach which is popularly known as 'standards and taxes' approach. This approach involves a pre-specified emission/discharge standard for each pollutant, together with a charge that is levied on the polluter if he/she exceeds the prescribed norms.

We want to stress the following points. First, it has been shown that market based instruments are superior to command and control principles. To discourage usage of polluting inputs and outputs, the states may levy a (quasi-Pigouvian) tax on the

[1] See end note at the end of the Appendix 3.

sectoral output. Whether such a tax will reduce pollution depends on the elasticity (which, in turn, depends on the availability of a greener substitute) of the sectors (from the demand side) as well as the cost of abatement (from the supply side). If the tax rate is higher than cost of abatement, the industry will abate and not pay any tax. On the other hand, if abatement cost is higher, the industry will continue to pollute and pay taxes. An estimate of the cost of abatement is given in Table A4.7.

Table A4.7: Abatement Cost Coefficients (US $, 1994) Per Ton of Pollutant Abated

Sl.No.	Industry	ISIC	PT	SO2	NO2	VOC	PB
1.	Sugar	3118	57.50	234.92	330.51	195.35	236.93
2.	Distillery	3131	176.39	622.54	2963.14	195.35	236.93
3.	Dye	3211	243.80	270.85	2670.28	819.34	1362.29
4.	Leather	3231	329.64	300.13	300.13	366.79	300.13
5.	Pulp and paper	3411	40.74	106.22	136.26	157.42	236.93
6.	Caustic soda	3511	2.42	222.48	146.34	133.38	444.34
7.	Fertiliser and pesticide	3512	69.01	183.94	510.55	295.79	79.32
8.	Petrochemical	3513	71.23	222.48	120.66	81.70	1413.43
9.	Drugs	3522	260.47	1311.88	706.55	141.26	354.34
10.	Oil refinery	3530	23.50	187.83	65.71	188.38	3.84
11.	Cement	3692	13.00	14.08	330.51	327.03	236.93
12.	Iron and steel	3710	167.8	40.69	106.03	2420.94	2176.47
13.	Aluminium, copper and zinc	3720	199.42	151.14	116.75	1326.9	874.22
		TXAIR	**AOTH**	**WCON**	**WNON**	**WTXMT**	**WTXOG**
1.	Sugar	1277.21	387.36	5.92	71.68	671.93	286.71
2.	Distillery	1277.21	387.36	183.49	319.26	671.93	286.71
3.	Dye	544.18	387.36	83.58	319.26	785.63	167.83
4.	Leather	300.13	300.13	148.50	442.17	2753.81	167.83
5.	Pulp and paper	544.18	62.94	84.17	185.36	671.93	286.71
6.	Caustic soda	22.46	39.87	175.72	281.69	671.93	205.95
7.	Fertiliser and pesticide	1352.11	159.73	954.46	487.03	671.93	448.19
8.	Petrochemical	70.04	51.05	592.01	369.16	671.93	532.80
9.	Drugs	81.94	387.36	452.89	397.00	671.93	1793.01
10.	Oil refinery	3.84	3.84	269.27	724.01	671.93	1016.51
11.	Cement	544.18	387.36	11.73	2741.22	671.93	286.71
12.	Iron and steel	667.97	387.36	91.25	279.01	486.93	87.32
13.	Aluminium, copper and zinc	2021.18	387.36	85.09	78.46	671.93	100.74

Source: Pandey (2005).

Note: PT – Particulate; AOTH – Others air pollutants; TXAIR – Toxic air pollutants; SO2 – Sulphur di-oxide; WCON – Conventional water pollutants; NO2 – Nitrogen dioxide; WNON – Non-conventional water pollutants; WTXOG – Toxic organic water pollutants; PB – Lead; VOC – Volatile organic compounds; WTXMT – Toxic metal water pollutants.

4.7 Towards a Tax Prescription

It is imperative to know that some of the most polluting inputs are also taxed heavily. This is shown in Table A4.8.

Table A4.8: Effective Tax Rate as Percent of Value Added

Industries	2003-04		2006-07	
	Effective Tax Rate (percent)	Rank out of 107 Industries	Effective Tax rate (percent)	Rank out of 103 Industries
Cement	9.89	61	12.54	50
Drugs and medicines	24.97	30	23.30	32
Fertilizers	28.08	26	24.67	28
Iron and steel, casting and forging	34.95	13	35.48	14
Iron and steel, foundries	56.68	6	52.04	7
Iron, steel and Ferro alloys	17.09	42	9.11	55
Leather and leather products	17.05	43	8.21	59
Motor vehicles	34.07	17	36.98	11
Non-ferrous basic metals	24.08	31	31.97	16
Paper, paper prods. and newsprint	31.45	22	35.30	15
Pesticides	23.35	34	20.15	38
Petroleum products	56.94	5	31.86	17
Sugar	6.69	68	24.07	31
Average of all industries	**(total=107) 17.41**		**(total=103) 18.15**	

Source (Basic Data): CSO, 2003-04 and 2006-07 Input Output Tables. Authors' calculation.

One can argue that the most polluting inputs are already heavily taxed (except energy inputs like Coal and lignite, Natural Gas and Crude Petroleum), such that there is a dis-incentive for intensive use of these inputs. If we allow for uniform tax rates across the board, such impediments vanish, and environmental problems will accentuate.

4.8 Summary

The discussion above presents a case against uniform treatment of various polluting and non polluting inputs under the forthcoming GST regime. Also, different states have different polluting industries, and the nature of pollution is not same across states. This calls for differential treatment by the states over and above what the uniform rate suggests. Some of the polluting inputs are already very heavily taxed; any attempt to remove these taxes will remove market incentive to move towards greener substitutes.

End Note

Measuring the Benefit

One faces serious informational problem in order to estimate the (health) benefits of reduced pollution (or costs of higher pollution). There are two dimensions of the problem. First, the health implications of different types of pollutants are not well understood. Even if they are, direct data, at least in case of India, are not forthcoming. One should therefore measure such benefits with extreme caution.

Brandon and Homman (1995) is a representative literature. They have estimated the excess morbidity due to air and water pollution using data on 36 Indian cities. Thus, one can estimate, however crudely, the benefit from reducing, say TSP. The reason behind focusing TSP is as follows. At least in this respect, the health issues are more or less clear. Some researchers (Kandlikar and Ramachandra, 2000) have argued that 'particulate matter is the major cause of human mortality and morbidity from air pollution'. If the ambient particulate concentrations are reduced to the WHO annual-average-standard, then 40,300 premature deaths together could have been avoided. This translates into, by a rough estimate, a benefit of the order $170-$1675 million.[1]

However, in India where discharge standards are in force for more than two decades and firms have adjusted their abatement activities to the discharge standards, a full charge system may not be acceptable to industries. There may also be resistance because of factors such as non-availability of technology for meeting more stringent targets and economic viability of meeting such targets. Since efficiency is by no means the only factor in designing a pollution control instrument, we may take an approach in which efficiency may have to be sacrificed marginally for the gain in its acceptability hence, implementation and enforcement ease.

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[1] This is the value statistical life: discounted value of a 10 year wage stream. The numbers are the lower and upper bounds of wage stream. The marginal benefit of reducing particulate concentration is thus (money saved)/ Δ(TSP). Given the large concentration of TSP in Indian cities, even a 50% reduction may not be enough to achieve the WHO par.

Appendix 5

TAXATION OF PETROLEUM AND PETROLEUM PRODUCTS AND COAL IN INDIA

5.1 Introduction

In the designing environmental taxes in India, taxation of petroleum products plays a key role. However, the tax burden on petroleum and petroleum products is often difficult to calculate because the pricing and taxation of petroleum and petroleum product is subject to various interventions including subsidisation, administered or quasi administered petroleum prices, and taxation by both the central and the state governments under central excises as well as states sales taxes. The ideal way of calculating the tax load on petroleum and petroleum products is to examine the difference between retail prices and relevant cost elements which may include price of crude petroleum (c.i.f import parity price) or price at factory gate were crude is produced domestically, markup of petroleum refining costs, and provision for transport costs upto the retail stage. The following sections describe various features of the pricing and taxation of petroleum products in India.

5.2 Environmental Tax Reforms in Respect of Petroleum Products

a. Pre 1958: Value Stock System and Other Ad hoc Arrangements

The oil pricing mechanism started in the late 1920s, when the private companies were marketing imported product (mainly kerosene) without any price controls either by the government or the companies. The situation changed with the second world war. The oil companies maintained price pools for major products during the war and post war periods (1939-1948). The first regulation on the oil prices was in 1948 between the Government of India and Burmah Shell. This was in the form of Valued Stock Account (VSA) and was based on import parity formula with Ras Tanura as the basing point. In this system, the basic selling prices of all the major petroleum products were determined as the sum of free on board Ras Tanura price, ocean freight, insurance, ocean loss, import duty, interest and other charges, as well as 10 percent remuneration. As Burmah Shell was a market price leader, it maintained separate VSA's for each of the product, and other companies followed the prices fixed by the leader. At the end of each year, collections at provisional basic selling price were set off against actual costs. The resultant surplus/ deficit were certified by auditors and advised to government. The selling prices were adjusted accordingly to keep the account in balance.

The VSA system was given up in 1958 as the government felt that the basis for pricing of petroleum products should be on actual costs rather than on assumed costs with reasonable profit mark up. Subsequently in April 1959, a new ad-hoc arrangement was entered into with oil companies and the Government of India. Thereafter, various pricing committees were appointed by the Government such as Dalme Committee (1961), Talukdar Committee (1965), and Shantilal Shah Committee (1969).

b. The Oil Price Committee and Administered Price Mechanism

In 1974, the Oil Prices Committee (OPC) was setup under the chairmanship of Krishnaswamy. In November 1976, the recommendation of the committee to discontinue the import parity pricing system and introduction of a pricing system based on domestic cost of production led to the introduction of Administered Pricing Mechanism (APM). The OPC recommendations were later modified by the Oil Cost Review Committee in 1984. Thereafter in September 1989, another Oil Prices Review Committee was constituted to examine the indigenous crude oil prices, prices of petroleum products and allied matters relating to crude oil movement, measurement, quality, etc. In June 1991, the recommendations of this committee were submitted but no action was taken on their findings.

Thus, APM continued through the late 1970s, 1980s and mid 1990s. Thereafter, due to the explosive growth in the latter-half of nineties the government had to rely on funds from private and international investors. The ability of the oil companies to generate investible surpluses was reduced considerably by the APM which allowed returns on the depreciated net fixed assets. In 1995, an Industry Study Group was setup under the chairmanship of Sundararajan to prepare a road map of reforms for the deregulation and tariff structure in the oil sector. These findings were to be inputs for the Planning Group on Restructuring of the Indian Oil Industry (known as the "R" group) headed by Vijay Kelkar. The findings of the R group was submitted in September, 1996 and were accepted by the government and to further continue the process of reforms, appointed an Expert Technical Group under Nirmal Singh to examine the phasing and tariff structure of the oil sector. Their recommendations were notified in November, 1997. Accordingly, in the first phase, effective 1.4.1998, the APM was dismantled for the upstream and refining sector and a partial deregulation took place for the marketing sector. The final dismantling of the APM was announced and made effective from 1.4.2002.

After dismantling of the APM in the petroleum sector and abolition of the erstwhile Oil Coordination Committee (OCC) the Petroleum Planning and Analysis Cell (PPAC) was created w.e.f. 1st April 2002 The Governing Body under the chairmanship of Secretary (PNG) and senior officials of Ministry of Petroleum & Natural Gas (MOP&NG) and Chief Executives of major oil and gas PSUs as members provides necessary supervision, guidelines in the functioning of PPAC. It is attached to Ministry of Petroleum & Natural Gas (MOP&NG) to assist the Government, inter alia, in the discharge of following functions:

1. Administration of subsidy on PDS Kerosene and domestic LPG and freight subsidy for farflung areas.
2. Maintenance of information data bank and communication system to deal with emergencies and unforeseen situations.
3. Analyzing the trends in the international oil market and domestic prices.
4. Forecasting and evaluation of petroleum import and export trends.

c. Standing Committee on petroleum and Natural Gas

In 2004, another Committee known at the Standing Committee on petroleum and Natural Gas (2004-05) was set up under the chairmanship of Janardhana Reddy. The committee examined the pricing of petroleum products. The findings of the committee were presented to fourteenth Lok Sabha on 4.08.2005 and to Rajya Sabha on 4.08.2005. The committee made the following recommendations:

(a) Government should peg the price of domestic crude to the free on board price of the respective marker crude in the international market;
(b) since term contracts are more flexible than spot tenders the Committee desired all refining companies to enhance the share of procurement through term contracts;
(c) reiterated that a Price Stabilisation Fund be created by pooling money collected from cess on crude oil to stabilise prices of petroleum products and utilise part of this cess to provide subsidy on kerosene and LPG;
(d) persuade state governments to reduce the royalty rates as this will bring down the final cost of crude and benefit the customer;
(e) scrap the import parity pricing method for products and instead go in for a more realistic method. Explore the option of pegging the product prices to free on board price of products prevailing in the global market, which is the price realization refineries abroad get and would be the net realization of oil companies if they were to export;

(f) Since the actual cost of refining and the refinery margin within the country are not taken into account in the pricing of products, the committee recommend that a realistic ceiling is to be worked out for the refinery margins with assistance of Tariff Commission in working out the actual refining cost especially in private refineries;

(g) expressed apprehension that any additional burden on excise on petroleum products, especially diesel, would be passed on to the consumers and this would have cascading effect on the prices of various essential commodities, therefore recommended that the increase in prices of such products should be kept at the minimum;

(h) as there exists a multitude of excise duties on petrol and diesel, the Committee recommended that the excise duties on petroleum products be so structured as to ensure that the interests of the consumer are not compromised. The Committee also recommended that the ad-valorem component in the existing mix should be replaced by a single specific component;

(i) the total share of taxes and duties in the retail selling prices of commonly used fuels including auto fuels should be rationalized;

(j) customs duties is only a mechanism to ensure fruitful gains to refining companies, therefore tariff protection to the public sector refineries can be ensured through rationalisation of excise duty;

(k) Committee observed that high incidence of state levies are mostly responsible for the high and varied retail selling prices of different products across the country, the central government should seriously take up these matters at appropriate level with the states and bring them to a consensus to reduce sales taxes considerably to a uniform floor rate;

(l) Committee observed that as the centre and the states are collecting huge revenues from the petroleum sector, the government should exercise restraint and apply the policy of prudence in making earnings from the oil sector;

(m) Committee felt as government is providing subsidies under the scheme of subsidy on domestic LPG and PDS kerosene, subsidy sharing needs to be widened by including all the refineries (both public and private sectors) in the country, considering the gains made by them within the existing system of pricing. The Committee, reiterated the need to continue subsidies on PDS kerosene and domestic LPG but recommend for an improved delivery mechanism, targeted at real beneficiaries, leaving no room for misappropriation or misuse;

(n) Committee recommended that the duty drawback incentive for export of petro goods by the government to be withdrawn and use the revenue gains on customs to bring down the excise duties on fuel. And pass on the benefit enjoyed by the exporters to the consumers in line with the stated policy of equitable distribution of burden;

(o) Explore alternative energy resources to reduce dependence on imports. As coal is the major energy source, specific plans to enhance coal bed methane production, coal gassification, coal cleaning technology etc. High priority should be given to technology upgradation or import of technology. More attention may towards the use of ethanol blending.

In December 2004, the government commissioned a study to assess the genuine demand of kerosene in different states/UTs. This study was entrusted to the National Council for Applied Economic Research (NCAER) and the report was submitted in October, 2005. This study estimated kerosene demand in 22 states and 1 Union Territory through a survey. It estimated that siphoning off of kerosene for non-household purpose is 18.1 percent, diversion of kerosene from PDS to open market is 17.9 percent and diversion of kerosene to no card households is 2.6 percent. Total leakage is thus estimated at 38.6 percent of total sale of PDS kerosene. On the basis of leakage of PDS kerosene, states were classified into four categories viz., extremely high leakage (more than 50 percent), very high leakage (40 to 50 percent), high leakage (20 to 40 percent) and low leakage (less than 20 percent). The details are as follows:

Extremely High Leakage (More than 50 percent)	**Very High Leakage (40-50 percent)**	**High Leakage (20-40 percent)**	**Low Leakage (Less than 20 percent)**
Six States	Four States	Nine States	Four States
Bihar, Chandigarh, Delhi, Jharkhand, Orissa and Punjab	Assam, Chhattisgarh, Tamil Nadu and Uttaranchal	Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Rajasthan and Uttar Pradesh	Goa, Himachal Pradesh, Kerala and West Bengal

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 spiralling 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.

d. Rangarajan Committee Recommendations

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 A5.1 gives the relevant comparison.

Table A5.1: 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 (January 2006) 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. These rates are shown in Table A5.2.

Table A5.2: 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

Source: Budget Documents.

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 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. 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.

e. Kirit Parikh Committee Recommendations

The Kirit Parikh Committee (2010) was set-up to provide a viable and sustainable system of pricing of petroleum products. The issues considered by the Committee and its main recommendations are summarized below:

1. The government does not permit oil companies to pass on the full cost of petroleum products (petrol, diesel, LPG, kerosene) to the final consumers due to several reasons:
   a) to protect poor consumers (eg., who use kerosene for lighting)
   b) to provide merit goods such as clean cooking fuels (eg., LPG over biomass)
   c) to insulate the domestic economy from the volatility of the international oil prices

2. However, it is very important that domestic prices should reflect international prices for the following reasons:
   a) increasing dependence on imports for oil

b) Huge under-recoveries of Oil-Marketing Companies (OMCs)
c) Undue stress on government finances and surplus of public sector oil companies
d) Overuse of petroleum products leading to adverse environmental impacts

3. Hence, a long-term viable strategy for pricing petroleum products is required with the principal objectives of
   a) reducing the fiscal burden of the government
   b) keeping the domestic oil industry financially healthy and competitive and therefore promote self-sufficiency in domestic production
   c) having an efficient and competitive oil economy that promotes efficient use by consumers

4. At current levels of prices of oil products, the financial burden of OMCs at different crude oil prices has been estimated and shown to be highly unsustainable calling for a change in policy. Such a policy should balance between the burdens that the consumer can bear and that the government can bear.

5. A case is made for full pass through of petrol prices to final consumers. One, since petrol is an item of final consumption, there will be little impact on inflation due to forward linkages. Two, the class of consumers who will use petrol belong to the upper two or three deciles of the population and there is no need to subsidize them. Even a significant rise in crude oil price (which gets passed) will increase their expenditure by an amount that can be borne easily by this class of consumers.

6. The committee recommends that diesel prices also should be market determined after analyzing the burdens that will be borne by different users
   a) Burden on agriculture can be accounted for in while fixing the MSP.
   b) Trucks and LCVs generally raise their rentals and higher diesel prices will also encourage fuel efficiency and railways for freight movement
   c) Even if they(power generators, industries, truckers) pass on their burden, it will still be lesser than the inflationary effect of subsidies
   d) Passenger cars that use diesel should be able to bear the additional cost.
   e) An additional excise duty of RS 80,000 should be levied on diesel vehicles corresponding to a differential rate on petrol

7. Kerosene price has been subsidized, the PDS price of which has remained at Rs 9 for a long time which has led to huge under recoveries. There is scope to change the allocation of kerosene.
   a) Kerosene is used largely for lighting and so the subsidy should be reduced as more BPL households are connected to the grid.
   b) The percentage of households using kerosene has declined and hence the kerosene allocation should also be reduced in tune to the use.
   c) There is significant scope to rationalize kerosene allocation across states.

   There is also scope to revise the price of PDS kerosene.
   a) Taking the growth rate of per capita GDP in agriculture as the ability of the rural poor to pay, the committee suggests that the price of kerosene can be raised by Rs 6/litre.
   b) The price of diesel and kerosene should be as close as possible to avoid adulteration of diesel with kerosene.

   Subsidy of kerosene should be targeted with smart cards. Till it comes into effect, the allocation between states should be rationalized to being down the all-India allocation by 20% and price can be increased to Rs 15/ litre.

8. LPG is a merit good and hence needs to be subsidized. But, looking at the consumption patterns, the subsidy is misdirected to the relatively affluent section who will be able to bear the full cost of LPG. Hence, the committee recommends that the price of a cylinder be increased by atleast Rs 100. This will be the single price that exists in the market and subsidies will be given to targeted groups based on smart cards.

5.3 Pricing of Petroleum Products

The pricing of petroleum products has under gone various changes over the years. The system moved away from valued stock accounts to import parity pricing, then to retention pricing and finally to market determined pricing mechanism. Since the complete dismantling of the APM, oil companies are allowed to sell their products at market determined prices by the concept of import parity. As a consequence, the retail prices in the domestic market tend to fluctuate with global price movements. The Oil Marketing Companies (OMCs) determine the selling price of petrol and diesel based on import parity mechanism (the price importer would pay for the imported product) with prior consultations with the Ministry of Petroleum & Natural Gas (MOP&NG). The various components of import parity price of the petroleum products are (a) Free on Board Price (FOB) as quoted in Arab Gulf market and reported by Platt and Argus, (b) premium/discount as published in Platt and Argus, (c) ocean freight from mid port in the Arab Gulf to Indian ports, (d) insurance, (e) exchange rate, (f) custom duty, (g) ocean loss, and (h) wharfage and port charges.

The retail prices of the products would be not on the actual ex-refinery prices of the product but as a markup on the notional price at which these products would have been imported. Thus, the retail selling price of petrol/diesel to the consumers is calculated by adding freight up to depots, marketing cost and margin, state specific irrecoverable levies, excise duty, delivery charges from depot to retail pump outlet, sales tax and other local levies, and dealers' commission to this basic price. The selling prices of petrol and diesel are uniform at all refinery locations throughout India as per the existing arrangement between the OMCs and refineries. The basic price at refinery level is revised fortnightly based on the prevalent international prices. Also, marketing costs and margins, dealers' commission, delivery charges within free delivery zones are also uniform. The prices at locations will vary depending upon the distance from the refinery, rate of sales tax and other local levies. In case of kerosene (PDS) and LPG (Domestic) the government has decided that the subsidies on these products will be on a specified flat rate basis for each depot/bottling plant and will be met from the fiscal budget. After providing for the aforesaid subsidy, the retail prices would then vary as per changes in the international oil prices.

Under the kerosene and domestic LPG subsidy scheme, 2002, Ministry of Petroleum and Natural Gas is administering the scheme through which the public sector Oil Marketing Companies are being paid subsidy at 1/3rd level of 2002-03 at a flat rate from the Union Budget. This translates to subsidy at the rate of Rs. 22.58 per 14.2 kg domestic LPG cylinder and Rs. 0.82 per litre on PDS Kerosene. Another scheme is the Freight Subsidy (for far flung areas) Scheme, 2002. Under this scheme, OMCs are being compensated on the freight being incurred to distribute the subsidized products in the far flung remote areas.

These schemes have been continued. On 11th October, 2007, the Government has approved further continuation of PDS Kerosene and Domestic LPG Subsidy Scheme 2002 and Freight Subsidy (For Far Flung Areas) Scheme, 2002 for a period of three more years from 1.4.2007 to 31.3.2010 at the same rates as followed from 2004-05 onwards i.e. at one-third level of the rate of subsidy of 2002-03.

During the year 2006-07, the following important activities and initiatives were taken by PPAC:

(i) Subsidy claims of oil companies under the government schemes on (a) domestic LPG, (b) PDS kerosene, and freight subsidy for far flung areas were processed by Petroleum Planning and Analysis Cell (PPAC) and a total amount of Rs. 2606 crore under the above schemes were disbursed to the oil companies for 2006-07.

(ii) In view of the growing importance of natural gas sector in the energy economy of the country as well as abroad, the methodology for collection of data on natural gas was formulated in consultation with the industry for timely collection, compilation and dissemination of data and statistics on natural gas. The relevant data are now being hosted in PPAC website (www.ppac.org.in)

(iii) In an open and globalised hydrocarbon sector like India's, the quality of data and statistics is of fundamental importance for effective policymaking.

In the case of petrol and diesel, international prices were increasing abnormally high during the period 2004-05. The government decided to allow OMCs to revise the price of MS/HSD within a price band based on the rolling average prices of these products in the international markets. They were permitted to make adjustment in a band of +/- 10 percent of the mean rolling average C&F prices. As prices further rose in the international market, government reduced both excise duty and customs duty on petrol and diesel. Even excise duties on LPG (domestic) and PDS kerosene was reduced. Since the situation deteriorated further Union Budget 2005-06 came up revised rates.

5.4 Tax Burden

The tax component which consists of customs duty, excise duty, sales tax and additional excise duty/cess account for a major share of the retail pricing of the petroleum products. The evidence to Janardhana Reddy Committee (2005) is as follow "Coming to the taxes, we have a build up of prices in which more than fifty per cent of the price is taxes. Taxes are about 132 percent of the basic price. Out of the total price, 57 percent is taxes for petrol; for diesel it is 35 percent. So, if Rs. 40 is the petrol price, then 57 percent, that means nearly Rs. 22 will be tax and Rs. 18 will be petrol price; if the price of diesel is Rs. 30, then one-third, that means Rs. 10 is tax and Rs. 20 is the price of diesel." Table A5.3 shows the special rates non-vatable for petroleum products for four states.

Table A5.3: VAT Rates for Petroleum, Diesel, High Speed Diesel and Kerosene[1]

(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	12.50
			b. To a retail trader or person situated outside the above three Municipal Corporations: 31 percent plus Re. 1 per litre.	
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 (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.

Notes: * 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.

Janardhana Reddy Committee (2005) shows that the percentage tax on petrol in the four metropolitan cities viz., Mumbai, Chennai, Kolkata and Delhi is 146 percent, 138 percent, 132 percent and 112 percent, respectively. The share of taxes in retail selling prices of petrol and diesel in Delhi, Chennai, Kolkata and Mumbai during 2004-05 is shown in Tables A5.4 and A5.5.

[1] 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 A5.4: Share of Duties and Taxes in Retail Selling Price of Petrol

(Rs/Litre)

S.N.	Particulars	Delhi	Chennai	Kolkata	Mumbai
1	Price without Customs Duty, Excise duty and sales tax components	17.87	17.28	17.60	17.54
2	Custom Duty @ 15% included in (RTP) Import parity, weighted average, base grade – Jan-II FN	1.71 (5.0)	1.71 (4.0)	1.71 (4.0)	1.71 (4.0)
3	Excise duty (levied @ 23% + Rs. 7.50 /litre plus 2 per cent education cess)	12.07 (32.0)	12.11 (29.0)	12.14 (30.0)	12.26 (28.0)
4	Sales Tax (incl. Irrecoverable taxes)	6.19 (16.0)	10.15 (25.0)	9.44 (23.0)	11.72 (27.0)
5	Total of Customs Duty, Excise Duty and Sales tax components (2+3+4)	19.97 (53.0)	23.97 (58.0)	23.29 (57.0)	25.69 (59.0)
6	Retail selling price at Delhi (1+5)	37.84	41.25	40.89	43.23

Source: Standing Committee on Petroleum and Natural Gas (2004-05), *Pricing of Petroleum Products*, 6th Report, Ministry of Petroleum and Natural Gas, Lok Sabha Secretariat, New Delhi, August, 2005.

Note: Figures in parentheses give the components of customs duty, excise duty and sales tax as a percentage of retail selling prices in Delhi.

Table A5.5: Share of Duties and Taxes in Retail Selling Price of Diesel

(Rs/Litre)

S.N.	Particulars	Delhi	Chennai	Kolkata	Mumbai
1	Price without Customs Duty, Excise duty and sales tax components	18.39	18.29	18.31	18.28
2	Custom Duty @ 15% included in (RTP Import parity, weighted average, base grade – Jan-II FN	1.97 (7.0)	1.97 (7.0)	1.97 (7.0)	1.97 (6.0)
3	Excise duty (levied @ 8% + Rs. 1.50/ litre plus 2% education cess)	3.15 (12.0)	3.15 (11.0)	3.17% (11.0)	3.18 (10.0)
4	Sales Tax (incl. Irrecoverable taxes)	2.77 (11.0)	5.89 (20.0)	5.27 (18.0)	9.40 (29.0)
5	Total of Customs Duty, Excise Duty and Sales tax components (2+3+4)	7.89 (30.0)	11.01 (38.0)	10.41 (36.0)	14.55 (44.0)
6	Retail selling price at Delhi (1+5)	26.28	29.30	28.72	32.83

Source: As in Table A5.4.

The Share of duties and taxes in the prices of petrol and diesel products in Delhi after the revision of retail prices made on 21.06.05 is shown in Table A5.6.

Table A5.6: Share of Duties and Taxes in the Prices of Petrol and Diesel in Delhi (as on 21.06.2005)

S. N.	Particulars	(Rs/Litre)
	Petrol	
1.	Price without Customs Duty, Excise duty and sales tax components	17.35
2.	Custom Duty (@ 10% included in RTP) Based on RTPs applicable for II fortnight of July 05).	1.65 (4.0)
3.	Excise Duty (levied @ 8% + Rs. 13/ Litre Plus 2% education cess)	14.74 (36.0)
4.	Sales Tax (incl. Irrecoverable taxes)	6.75 (17.0)
5.	Total of Customs Duty, Excise Duty and Sales Tax components (2+3+4)	23.14 (57.0)
6.	Retail Selling Price (1+5)	40.49

	Diesel	
1.	Price without Customs Duty, Excise duty and sales tax components	18.37
2.	Custom Duty (@10% included in RTP) Based on RTPs applicable for II fortnight of July 05.	1.99 (7.0)
3.	Excise Duty (Levied @ 8% + Rs. 3.25/litre plus 2% education cess)	4.93 (17.0)
4.	Sales Tax (incl. Irrecoverable taxes)	3.16 (11.0)
5.	Total of Custom Duty, Excise Duty and Sales Tax components (2+3+4)	10.08 (35.0)
6.	Retail Selling Price (1+5)	28.45

Source: As in Table A5.4.

The share of duties and taxes in the retail selling prices of LPG and kerosene during 2004-05 before effecting the changes in the Budget (2005-06) are shown in Tables A5.7 and A5.8.

Table A5.7: Share of Duties and Taxes in Retail Selling Price of LPG (Packed Domestic)

Sl. No.	Particulars	Delhi	Chennai	Kolkata	Mumbai
1	Price without Customs Duty, Excise duty and sales tax components	229.51	228.13	230.41	228.10
2	Custom Duty @ 5% included in (RTP Simple average for all ports, – Jan'05 RTP	14.69 (5.0)	14.69 (5.0)	14.69 (5.0)	14.69 (5.0)
3	Excise duty (Presently levied @ 8%)	17.75 (6.0)	18.21 (6.0)	18.13 (6.0)	17.97 (6.0)
4	Sales Tax (incl. Irrecoverable taxes)	19.65 (7.0)	27.12 (9.0)	46.42 (15.0)	31.09 (11.0)
5	Total of Customs Duty, Excise Duty and Sales tax components (2+3+4)	52.09 (18.0)	60.02 (21.0)	79.24 (26.0)	63.75 (22.0)
6	Retail selling price at Delhi (1+5)	281.60	288.15	309.65	291.85

Source: As in Table A5.4.

Table A5.8: Share of Duties and Taxes in Retail Selling Price of PDS Kerosene

Sl. No.	Particulars	Delhi	Chennai	Kolkata	Mumbai
1	Price without Customs Duty, Excise duty and sales tax components	7.13	6.41	7.31	7.12
2	Custom Duty (@ 5% included in RTP) Simple average for all ports Jan'05 RTP	0.70 (8.0)	0.70 (8.0)	0.70 (8.0)	0.70 (8.0)
3	Excise duty (Presently levied @ 12%)	0.86 (10.0)	0.87 (10.0)	0.86 (9.0)	0.86 (9.0)
4	Sales Tax (incl. Irrecoverable taxes)	0.32 (4.0)	0.42 (5.0)	0.43 (5.0)	0.58 (6.0)
5	Total of Customs Duty, Excise Duty and Sales tax components (2+3+4)	1.88 (21.0)	1.99 (24.0)	1.99 (21.0)	2.14 (23.0)
6	Retail selling price at Delhi (1+5)	9.01	8.40	9.30	9.26

Source: As in Table A5.4.

The retail prices of petroleum products vary widely from state to state as the final prices of these products include an element of state sales tax also. In some states sales tax is very high. For example, sales tax on diesel is close to 37.97 percent in Mumbai, whereas it is only 12.5 percent in Delhi. The effective (as on 01.07.2005) rates of recoverable sales tax on petrol, diesel, PDS kerosene and domestic LPG in various states/ UT's is shown in Table A5. 9.

Reduction/Changes in Central Taxes

The excise duties on petrol were scaled down from 30 to 26 percent, on diesel from 14 to 11 percent and on LPG from 16 to 8 percent effective June 16th 2004. Effective 19 th August 2004, further reduction in excise duties on refined products was given effect to. The applicable excise duty on petrol was lowered from 26 to 23 percent and that on diesel brought down from 11 to 8 percent. This was combined with reduction in the customs duty on petrol and diesel from 20 to 15 percent. Similarly, excise duty on PDS kerosene was scaled down from 16 to 12 percent and customs duty on LPG and Kerosene from 10 to 5 percent. Effective 1st March 2005, the customs and excise duty on PDS Kerosene and LPG for domestic use were reduced to zero.

Table A5.9: Effective Rates of Sales Tax/VAT

(Percentage)

States	Sales Tax/VAT as on 01.07.2005			
	Petrol	**Diesel**	**PDS Kerosene**	**Domestic**
Andhra Pradesh	34.0	23.0	4.0	12.5
Arunachal Pradesh	20.0	12.5	4.0	12.5
Assam	27.5	16.5	4.0	9.0
Bihar	27.0	22.0	12.5	12.5
Chhattisgarh	25.0	25.0	2.3	9.2
Chandigarh	22.0	12.1	8.8	8.8
Delhi	20.0	12.5	4.0	12.5
Goa	24.9	22.9	4.0	12.5
Gujarat	25.4	22.8	0.0	14.0
Haryana	20.5	12.2	4.0	12.5
Himachal Pradesh	25.0	14.0	0.0	12.5
Jammu and Kashmir	20.0	12.0	4.0	12.5
	+Re1/Ltr as cess			
Jharkhand	20.0	15.0	6.0	9.0
Karnataka	29.4	21.0	4.0	12.5
Kerala	28.0	24.0	4.0	12.5
Maharashtra				
1-Mumbai, Thane and Navi Mumbai	30.0	34.0	4.0	12.5
	Re1/Ltr as Surcharge	+ Re 1/Ltr as Surcharge		
2- Others	29.0	31.0	4 .0	12.5
	+ Re 1/Ltr as Surcharge			
Madhya Pradesh	28.8	28.8	0.0	13.8
Manipur	20.0	12.5	0.0	12.5
Meghalaya	20.4	12.8	4.0	12.5
Mizoram	20.0	12.0	0.0	8.0
Nagaland	21.0	12.6	5.3	12.6
Orissa	20.0	20.0	4.0	12.5
Punjab	27.5	8.8	4.0	12.5
	+Re1/Ltr as Cess			
Rajasthan	28.0	20.0	9.0	14.0
	+Re 0.50/Ltr as Cess	+Re 0.50/Ltr as Cess		
Sikkim	17.6	9.3	12.0	12.5
	+Re 1/Ltr. as Cess			
Tamil Nadu	30.0	25.0	4.0	8.0
Tripura	20.0	12.5	4.0	12.5
Uttaranchal	25.0	21.0	10.0	10.0
Uttar Pradesh	26.0	22.0	10.1	10.1
West Bengal	25.0	17.0	4.0	12.5
	+Re1/lLitre as Surcharge			

Source: As in Table A5.4.
Note: Excludes entry tax wherever, applicable. Includes impact of VAT in dealers' commission wherever applicable.

Effective from 1st March 2005, the customs duty on petrol and diesel were reduced from 15 to 10 percent and that on crude oil brought down from 10 to 5 percent. The customs duty on aviation turbine fuel (ATF), furnace oil (FO) [for general use], low sulphur heavy stock (LSHS) [for general use] and bitumen were reduced from 20 to 10 percent. Customs duty on Naphtha, FO and LSHS for fertilizer use continued to remain NIL. The resultant loss of tax revenue was neutralised by way of increase in the excise duties on petrol and diesel. Accordingly, the excise duty on petrol was revised from 23 percent plus Rs. 7.50 per litre to 8 percent plus Rs. 13.00 per litre (from Rs. 12.07 per litre to Rs. 14.59 per litre) and on diesel from 8 percent plus Rs. 1.50 per litre to 8 percent plus Rs. 3.25 per litre (from Rs. 3.15 per litre to Rs. 4.80 per litre). Consequent to enactment of Finance Bill 2006, LPG (Domestic) becomes "Declared Goods" under CST Act and the maximum sales tax/VAT rate is 4 percent effective 19.04.2006 across all states/UTs. This will reduce the sales tax levied by states to 4 percent as against VAT rate of 12.5 percent levied by most of the states currently. This is also expected to marginally reduce the under-recoveries of oil marketing companies without revising retail selling prices of domestic LPG. Effective 16.06.2006 government has reduced customs duty on petrol and diesel from 10 to 7.5 percent in line with recommendations made by Rangarajan Committee. Effective 1st March, 2007, the ad-valorem rates of excise duty on petrol and diesel have been revised from 8 to 6 percent. However, effective 1.03.2007, education cess has been revised from 2 to 3 percent.

5.5 Costs in Refining of Petroleum Products

While examining the pricing of petroleum products the refining capacity, refining cost and refining margin play an important. The country is surplus in refining capacity as compared to the consumption. There are 18 refineries operating in the country, 17 in public sector[1] and 1 in private sector that belongs to Reliance Industries Limited. Total refining capacity as on 1.10.2004 was 127.37 MMT per annum. Out of this, private refining capacity is 33 MMT per annum, which works out to be 25.9 percent of the total refining capacity.

The cost of a refined product consists of about 90-95 percent crude cost and 5-10 percent refining cost. The steep rise in global oil prices during 2004-05 had upset all

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[1] Mangalore Refinery and Petrochemicals Limited (MRPL) which was a Joint Sector Company became a PSU subsequent to acquisition of its majority shares by ONGC. Out of the 17 Public sector refineries, 7 are owned by Indian Oil Corporation Limited, two each by Chennai Petroleum Corporation Limited (a subsidiary of IOCL), Hindustan Petroleum Corporation Limited and Oil and Natural Gas Corporation Limited (ONGC), one each by Bharat Petroleum Corporation Limited, Kochi Refineries Limited (a subsidiary of BPCL), Numaligarh Refinery Limited (a subsidiary of Bharat Petroleum Corporation) and Bongaigaon Refineries and Petrochemicals (a subsidiary of IOC).

such notions. To this the Secretary, M/o Petroleum and Natural Gas reply to Janardhana Reddy Committee is as follows:

> "It is not that they earn a margin of twelve dollars throughout the year. It is fluctuating because it is dependent on the supply position and the scarcity position. The refineries have been quite uniformly having a good margin this year, but the figure is not going to be twelve dollars. They have been having a margin in the range of seven to eight dollars per barrel throughout the year. That is the reason why they were able to generate more surplus funds. What we are saying is that, if these refineries were not there, then, we would have to import at that price…".

The refining cost and refining margin of various refineries in the country for three years 2001-02 to 2003-04 are shown in Table A5.10 and their shares in the price of the refined product is shown in Table A5.11.

Table A5.10: Refining Cost and Refinery Margin of Various Refiners

(Rs./MT)

Refinery	2001-02		2002-03		2003-04	
	Refining Cost	Refinery Margin	Refining Cost	Refinery Margin	Refining Cost	Refinery Margin
IOC						
Guwahati	1465	-1398	2609	811	1594	1824
Barauni	697	-168	939	790	819	865
Gujarat	372	543	388	1414	328	1744
Haldia	710	-0.12	718	337	779	685
Mathura	343	605	318	2436	319	2057
Panipat	427	243	410	1812	414	1920
Digboi	2286	-294	2402	2737	3140	2616
CPCL	405	682	568	1397	597	1473
BRPL	587	-309	716	2444	516	1685
BPC	474	858	479	1350	483	1601
KRL	466	868	443	1490	394	1604
NRL	858	896	977	2247	937	1928
HPCL						
Mumbai	494	634	539	1010	581	1442
Vizag	432	587	485	1565	450	1559
MRPL	1365	626	919	718	646	1271

Source: As in Table A5.4.

Table A5.11: The Share of Crude and Refining Cost in the Price of Refined Product

(percent)

Oil Companies/ Years	Crude Cost	Refining Cost
IOC		
2003-04	84.35	4.23
2002-03	85.59	4.22
2001-02	94.02	5.52
BPCL		
2003-04	87.29	3.83
2002-03	89.03	3.9
2001-02	89.47	5.81
HPCL		
2003-04	87.51	3.81
2002-03		
2001-02	92.56	4.67
CPCL		
2003-04	81.45	4.39
2002-03	83.84	4.48
2001-02	90.47	4.39
KRL		
2003-04	87.18	3.8
2002-03	88.06	3.87
2001-02	89.94	5.82
NRL		
2003-04	82.52	7.96
2002-03	79.74	8.27
2001-02	81.68	12.4
BRPL		
2003-04	88.49	4.34
2002-03	80.56	6.2
2001-02	103.14	8.49
MRPL		
2003-04	91.72	5.3
2002-03	94.11	7.64
2001-02	89.76	12.51

Source: As in Table A5.4.

5.6 Global Changes in Pricing and Taxation of Petroleum Products

The global prices of crude oil and petroleum products have remained high and volatile. The phenomenal increase in price of crude oil and petroleum products in the

International market has assumed alarming proportions. The Indian Basket crude oil touched an all time high of $ 94.62 per barrel on 03.01.2008. The average price of Indian Basket of crude oil, during the period April-December 2007 has been $ 74.39 per barrel. This steep increase in prices is having major impact on the oil marketing companies (OMCs) and the Indian economy, as India imports about 79 percent of crude oil requirement of refineries.

The trend in the international prices of Indian basket of crude oil and sensitive petroleum products for March 2002 to 2007-08 (upto 21.01.2008) is shown in Table A5.12.

Table A5.12: Trends in International Oil Prices and Domestic Prices

Period	Crude oil (Indian Basket) $/bbl	Petrol $/bbl	Diesel $/bbl	Kerosene $/bbl	LPG $/ MT
2001-02	23.31	26.43	23.27	23.65	194.00
2002-03	26.66	30.15	28.93	29.33	280.40
2003-04	27.96	35.03	30.48	31.19	278.45
2004-05	39.22	49.01	46.91	49.50	368.52
2005-06	55.72	64.51	64.70	69.43	481.04
2006-07	62.46	72.62	74.12	77.03	499.67
2007-08	75.61	87.39	88.15	89.97	650.07

Source: Annual Report of Petroleum Ministry 2007-08.

Notes:
1. The composition of Indian basket of crude represents average of Oman & Dubai for sour grades and Brent (Dated) for sweet grade in the ratio of 61.4 and 38.6 for 2007-08, 59.8:40.2 for the year 2006-07, 58:42 for the year 2005-06 and 57:43 for the prior period.
2. Price of kerosene is for Arab Gulf Market - LPG Price is Saudi Aramco CP based on 60:40 butane / propane ratio.
3. Price of Petrol is 92 RON unleaded for Singapore market.
4. Price of Diesel is for 0.5 percent sulphur for Arab Gulf Market

Despite the increase in the international oil prices, the selling prices of petrol and diesel were not revised by the Public Sector Oil Marketing Companies (OMCs) in tune with the international oil prices. The prices of petrol and diesel have been reduced by Rs. 2 per litre and Re. 1 per litre respectively with effect from 16.02.2007. Similarly, the basic prices of domestic LPG and PDS kerosene were not revised despite steep increase in the international oil prices. The retail selling prices of LPG (Domestic) has not been revised since November 2004 and the price of Kerosene (PDS) has not been revised since March 2002.

While passing on the entire impact of the steep increase in the oil prices to the consumers would have resulted in steep increase in the domestic prices, the Government took certain measures in favour of vulnerable sections of society and vulnerable segments of the economy, by ensuring that the burden was shared by all the stakeholders, namely, the Government, the oil companies and the consumers. Accordingly, an appropriate mechanism for sharing the under-recoveries of OMCs was put in operation to ensure that the burden was shared by all the stakeholders, namely:

- Government through issue of oil bonds
- Oil companies through upstream / refinery discounts
- Consumers through minimal price increase
- Balance of the under-recoveries would be borne by the OMCs

The Government has decided to issue Oil Bonds towards 42.7 percent of the total under-recoveries for the current financial year i.e. 2007-08 to OMCs.

5.7. Distributional Impact of Fuel Tax Policies

Most studies that examined the impact of fuel tax policies on the consumers have found that the taxes are regressive in nature. However, Datta (2008) argues that this need not be the case. He criticizes these studies on two main points. First, most of these studies were done in developed countries like the US where even the poor own cars. Secondly, most studies measure fuel tax incidence against income and not consumption expenditure which is a better long run indicator of economic well being.

Datta examined the incidence of fuel taxes across consumption expenditure classes in India by looking at both the direct and the indirect effects of fuel taxation on households, both in a closed economy and open economy. The direct effect arises because of direct consumption of the fuel by the household. Thus, an increase in the price of the fuel affects the budget of the household. While the indirect effects include the effect of a fuel price rise on other commodities for which the fuel is used as an intermediate input. Here, fuel tax indirectly affects the household budget by increasing the price of other commodities.

The data on consumer expenditure on fuel and other commodities is obtained from the consumption schedule of the 61st round of the National Sample Survey conducted by the NSSO during the period 2004-05. Since the data does not have information on household income, incidence is measured across expenditure classes. The Input-Output tables of India prepared by CSO are used to account for the indirect consumption of fuels through its use as an intermediate input in the production of final goods. The tables for the years 1998-99 and 2003-04 are used. The 1998-99 tables are used as it gives information on energy sectors at a more disaggregated level. It gives information on coal, gas and petroleum products sectors. Datta has also added a kerosene sector. He assumes that this sector has the same inputs as the petroleum products industry and that kerosene is not used as an input for any other sector. The 2003-04 table has only 2 energy sectors – coal and petroleum products. Transport fuels, kerosene, gas, etc are included in the petroleum products sector. The 1998-99 table provided information on 115 sectors. However to make it compatible with the NSSO data, the author created an aggregated input-output matrix with 47 sectors. The 2003-04 input-output table had 130 sectors which were aggregated to 46 sectors.

Datta makes two assumptions (i) that the production function for the taxed commodity is assumed to show fixed coefficient technology, and (ii) inelastic Hicksian demand for fuel is assumed. In the first assumption the supply curve of the taxed commodity is perfectly elastic. Consumers bear the entire burden of the tax. In the second, a change in the price of the fuel will not lead to a change in the quantity bought by households.

The analysis is carried out for direct and indirect effects. In the case of direct effects he assumes that the taxed commodity is not used as an intermediate input in the production of another commodity. Hence, an increase in the price of the taxed commodity does not affect the prices of other commodities. In this case, tax burden can be measured by simply looking at the budget share of the taxed commodity in the household's total consumption expenditure.

The budget share for different cooking, lighting and transport fuels across 10 consumption deciles was graphed. This was done separately for the rural and urban sector. It was found that of all the cooking and lighting fuels, only kerosene is regressive, i.e., kerosene's budget share decreases with consumption. LPG is progressive for the rural sector, while maximum burden falls on the middle deciles in the urban sector. The budget share of coal is low for all deciles. The curve, however, is slightly curved indicating that the middle consumptions deciles bear the maximum burden. Budget share of transport fuels increases with consumption indicating progressivity. In the urban sector the progressivity is much higher. This is logical as most of the households have access to private transport in the urban areas. In the case of diesel the curve almost flat but is slightly upward sloping for top consumption deciles. This implies that the number of households using diesel vehicles for private transport is negligible. However, transport fuel is an important input in the production process if this is taken the findings could alter or the progressivity may increase.

As the indirect effects play an important role in determining the distributional effects of fuel tax, Dutta use the Input-Output tables to account for the effect of fuel taxes on the prices of other commodities. This is done separately for a closed economy with advalorem indirect taxes and for an open economy with unit taxes. The formula for calculating tax burden for the k^{th} household is given below.

For a closed economy,

$$TB_k = P_i dt_i \left[\frac{X_k (I - A^T - T)^{-1} e_i}{Y_k} \right]$$

For an open economy,

$$TB_k = \left[\frac{X_k (I - D^T)^{-1} e_i}{Y_k} \right] dt_i^d$$

Where,

TB_k = tax burden of the k^{th} household

Pi = Price of the i^{th} commodity

t_i = Tax rate for i^{th} commodity

X_k = (1*n) vector of quantities purchased by household k

Y_k = Consumption expenditure of household k

I = (n*n) identity matrix

A = (n*n) input-output matrix

D = (n*n) matrix of domestic input use

T = (n*n) diagonal matrix with tax rates in the diagonal

e_i = (n*1) column vector with 1 in the i^{th} place and 0 in every other place

The term outside the parenthesis is the same for all the households. Thus, we need calculate only the term within. This can be interpreted as the share of commodity i in household k's expenditure taking all indirect effects into account.

The analysis shows that for a closed economy, the results change a little from the direct effects case. Since it was assumed that kerosene does not enter into any sector's production function, the incidence for a kerosene tax remains the same as before. The gas tax and petroleum products tax remains progressive. Like before, for the urban sector the gas tax curve becomes inverted U shaped implying maximum burden on the middle consumption deciles. The coal tax becomes progressive with the inclusion of indirect effects. This is expected as rich households spend a bigger proportion of their total expenditure on energy and manufactured goods for which coal is an important input. Using 2003-04 tables gives similar results.

The open economy analysis was performed using 2003-04 input-output tables. The coal tax in this case is neutral. For the petroleum products sector (which includes transport fuels, kerosene and gas), tax is progressive.

Until now Dutt assumed that demand was inelastic. Now he uses elasticity estimates from different sources, to carry out sensitivity check to show that the progressivity results do not change for reasonable levels of elasticity. Only 5 commodities were considered for this analysis – coal, gas, petroleum products, kerosene and others (non fuel consumption).

For progressivity, the tax burden on the rich (R) has to be greater than the tax burden on the poor (P). After including the cross price elasticities into the tax burden formula, we get the following condition for progressivity.

$$\sum_{i=1}^{n} P_i' \left[(1+\sum_{j=1}^{n} \alpha_{ji}^{R} dP_j) D_i^R - (1+\sum_{j=1}^{n} \alpha_{ji}^{P} dP_j) D_i^P \right] > 0$$

Where,

P = Price of the commodity

α_{ji} = Compensated Hicksian price elasticity of commodity I with respect to price of commodity j

D_i^K = Budget share of the ith commodity in k's budget [k = R, P]

This formula was applied for both the rural and urban sector. The budget share for an average individual of the first and the last decile were taken to represent the poor and the rich respectively. For the rural, it was found that while petroleum products and gas are progressive, kerosene is regressive. Coal was found to be neutral. For the urban sector, tax on transport fuels is strongly progressive, while the other taxes are regressive.

The Hicksian own price and cross price elasticities for the rural poor and rich are given in Tables A5.13 and A5.14.

Table A5.13: Estimated Hicksian Own Price Elasticity for Commodities: Rural Poor

		Prices				
		Coal	**Petroleum**	**Gas**	**Kerosene**	**Others**
Demand	**Coal**	-0.126	0.000	0.843	0.712	-1.429
	Petroleum	0.000	-0.420	0.000	0.000	0.420
	Gas	0.596	0.000	-0.484	0.470	-0.582
	Kerosene	0.239	0.000	0.223	-0.630	0.168
	Others	-0.006	0.000	-0.005	0.015	-0.005

Source: Datta, Ashokankur (2008), "*The Incidence of Fuel Taxation in India*", Discussion Paper 08-05, ISI, Planning Unit, Delhi.

Table A5.14: Estimated Hicksian Own Price Elasticity for Commodities: Rural Rich

		Prices				
		Coal	**Petroleum**	**Gas**	**Kerosene**	**Others**
Demand	**Coal**	-0.330	0.000	0.565	0.495	-0.730
	Petroleum	0.000	-0.390	0.000	0.000	0.390
	Gas	0.520	0.000	-0.512	0.458	-0.466
	Kerosene	0.174	0.000	0.175	-0.705	0.356
	Others	-0.012	0.009	0.009	-0.003	-0.004

Source: As in Table A5.13.

Similarly, the Hicksian own price and cross price elasticities for the urban poor and rich are given in Tables A5.15 and A5.16.

Table A5.15: Estimated Hicksian Own Price Elasticity for Commodities: Urban Poor

		Prices				
		Coal	**Petroleum**	**Gas**	**Kerosene**	**Others**
Demand	**Coal**	0.005	0.000	0.653	0.028	-0.687
	Petroleum	0.000	-0.419	0.000	0.000	0.419
	Gas	0.661	0.000	-0.447	0.604	-0.818
	Kerosene	0.004	0.000	0.309	0.000	-0.313
	Others	-0.001	0.001	0.016	-0.008	-0.009

Source: As in Table A5.13.

Table A5.16: Estimated Hicksian Own Price Elasticity for Commodities: Urban Rich

		Prices				
		Coal	Petroleum	Gas	Kerosene	Others
Demand	**Coal**	0.005	0.000	0.384	0.028	-0.418
	Petroleum	0.000	-0.418	0.000	0.000	0.418
	Gas	0.507	0.000	-0.519	1.102	-1.090
	Kerosene	0.004	0.000	0.443	0.000	-0.447
	Others	-0.001	0.001	0.016	-0.008	-0.009

Source: As in Table A5.13.

In brief, Datta analysis shows that for an environmental tax to be effective, the fuel should have elastic demand and high emission potential. Transport fuels satisfy both these conditions and are progressive. Thus, there is an appropriate case for a fuel tax. Their emission potential is around 2.3 kilograms of carbon dioxide per litre of fuel. Different studies have found transport fuel elasticity to be -0.84 and -0.42, both of which values are price sensitive.

A gas tax is also progressive and has a high elasticity (close to unity for almost all sections of the society). However, the case for a gas tax is not strong as gas is a relatively cleaner fuel.

Kerosene is an important fuel in India especially in the rural sector. It is of relatively poor quality and has high elasticity. The elasticity value ranges from -0.7 for the rural rich to -0.5 for the middle expenditure group. However, a kerosene tax was found to be regressive. Therefore, any tax on kerosene should be accompanied by compensatory proposals for the poor.

5.8 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 geological resources of coal and the type and categories-wise coal resources in India are shown in Tables A5.17 and A5.18.

Table A5.17: Geological Resources of Coal in India as on 1.4.2007

(in Million Tonnes)

State	Proved	Indicated	Inferred	Total
Andhra Pradesh	8791	6266	2658	17715
Arunachal Pradesh	31	40	19	90
Assam	314	27	34	375
Bihar	0	0	160	160
Chhattisgarh	10182	26826	4442	41450
Jharkhand	36960	31094	6338	74392
Madhya Pradesh	7872	9692	2782	20346
Maharashtra	4856	2822	1992	9670
Meghalaya	118	41	301	460
Nagaland	4	1	15	20
Orissa	17712	31207	14314	63233
Sikkim	0	55	18	73
Uttar Pradesh	766	296	0	1062
West Bengal	11454	11810	5071	28335
Total	**99060**	**120177**	**38144**	**257381**

Source: Ministry of Coal Annual Report, 2007-08.

Table A5.18: Type-wise and Category-wise Coal Resources of India as on 1.4.2007

(in Million Tonnes)

	Coal	Proved	Indicated	Inferred	Total
A.	Coking				
	Prime Coking	4614	699		5313
	Medium Coking	11853	11601	1880	25334
	Semi Coking	482	1003	222	1707
	Sub Total Cocking	**16949**	**13303**	**2102**	**32354**
B.	Non-Coking	81644	106768	35673	224085
C.	Tertiary Coal	467	106	369	942
	Total (A+B+C)	**99060**	**120177**	**38144**	**257381**

Source: Ministry of Coal Annual Report, 2007-08.

The Working Group for Coal and Lignite for the formulation of the Eleventh Plan has assessed the coal demand of 731.00 metric tonnes (MTs) in 2011-12. The All India coal demand for the year 2007-08 and 2008-09 has been assessed as 492.50 MTs and 555.00 MTs, respectively. Sector wise break-up is given in Table A5.19. 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.

Table A5.19: Coal Demand in India

(in Million Tonnes)

Sectors	**2007-08**	**2008-09**	**XI Plan Project**
			(2011 – 12)
Steel & Coke-Oven	38.0	44.0	68.5
Power (Utility)	330.0	378.0	483.0
Power (Captive)	33.6	38.0	57.1
Cement	26.8	25.0	31.9
Sponge Iron	15.1	18.0	29.0
BRK & Others	49.0	52.0	61.6
Total	**492.5**	**555.0**	**731.0**

Source: Ministry of Coal Annual Report, 2007-08.

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.

The Indigenous coal supply projection at the end of Eleventh Plan is projected to be 680.00 MT. Out of these, share of Coal India Limited (CIL) and Singareni Collieries Company Limited (SCCL) sources are 520.50 MT and 40.80 MT, respectively. Other producers comprising of PSUs, state enterprises and captive producers are expected to increase supply of coal to 118.70 MT. The demand – supply gap is estimated at 51.00 MT, which will be met by imports of 40.85 MT of coking coal and 10.15 MT of non-coking coal (Table A5.20).

Table A5.20: Coal Supply in India

(in Million Tonnes)

Source	2007-08 RE	2008-09 BE	XI Plan Project (2011 – 12)
CIL	385.9	405	520.5
SCCL	40.508	41.5	40.8
Others	36.85	50.79	118.7
Total Indigenous Supply	**463.258**	**497.29**	**680**
Import			
Coking	19.00*	17.8	40.85
Non-Coking	10.45*	40.36	10.15
Total	**29.45**	**58.16**	**51.00**
Gap	0	+0.45	0

Source: Ministry of Coal Annual Report, 2007-08.
Note: * As per the Annual Plan 2007-08.

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.

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 consumers 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 A5.21 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 set up on 2.06.2005 examined the issue of further revision of royalty rates and submitted its report in July 2006. [1] 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.

[1] GoI (2007), Annual Report, 2006-07, Ministry of Coal, http://coal.nic.in.

Table A5.21: 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.

The Government revised the royalty rates on coal and lignite w.e.f 01.08.2007 on the basis of a formula consisting of ad-valorem plus a fixed component. The royalty rates (R) are a combination of specific and ad valorem rates.

R (Royalty Rupees/tonne) = a + bP

Where 'P' (price) shall mean basic pithead price of ROM (run-of-mine) coal and lignite as reflected in the invoice, excluding taxes, levies and other charges and the values of 'a' (fixed component) and 'b' (variable or advalorem component); "b" has been fixed at 5 percent of the invoice price, excluding taxes etc, and the fixed component is different as per the grade of coal. This royalty revision is likely to give to the States an increase of about 23-24 percent in revenue by way of Royalty.

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 treatment[1]. 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. The MSE (2008) recommend a similar but somewhat simplified structure of the eco-cess as given in Table A5.22.

Table A5.22: 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

A cess is 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 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.

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[1] The MSE (2007) study recommended the following rates:

		Rate of Eco Cess (Rs. per tonne)	Ash Percent		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			

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. The 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.

5.9 Summary

The mechanism of oil pricing started when the private companies were marketing imported product (mainly kerosene) without any price controls either by the government or the companies in the late 1920s. The situation changed when the oil companies maintained price pools for major products during the war and post war periods. The first regulation on the oil prices was in 1948 between the Government of India and Burmah Shell. This was in the form of Valued Stock Account (VSA) and was based on import parity formula with Ras Tanura as the basing point. This system was given up in 1958 and subsequently in April 1959, a new ad-hoc arrangement was entered into with oil companies and the Government of India. Thereafter, various pricing committees were appointed by the Government such as Dalme Committee (1961), Talukdar Committee (1965), Shantilal Shah Committee (1969), Krishnaswamy Committee (1974), introduction of Administered Pricing Mechanism (APM) in November 1976, the Oil Cost Review Committee (1984) and Oil Prices Review Committee (1989). Thus, APM continued through the late 1970s, 1980s and mid 1990s. Thereafter, an Industry Study Group (1995) under the chairmanship of Sundararajan, the Planning Group on Restructuring of the Indian Oil Industry (known as the "R" group) headed by Vijay Kelkar, an Expert Technical Group under Nirmal Singh to examine the phasing and tariff structure of the oil sector. This committee recommended dismantling of APM. In April 2002 the Petroleum

Planning and Analysis Cell (PPAC) was created. The Governing Body under the chairmanship of Secretary (PNG) and senior officials of Ministry of Petroleum & Natural Gas (MOP&NG) and Chief Executives of major oil and gas PSUs as members provides necessary supervision, guidelines in the functioning of PPAC. In 2004, another Committee known at the Standing Committee on petroleum and Natural Gas (2004-05) was set up under the chairmanship of Janardhana Reddy. The committee examined the pricing of petroleum products. This was followed by the Rangarajan Committee (2006).

The tax burden on the citizens of India increased over the year. In 2004, the retail prices of petroleum products varied widely from state to state as the final prices of these products include an element of state sales tax. In some states sales tax is very high. Effective 1st March 2005, the customs and excise duty on PDS Kerosene and LPG for domestic use were reduced to zero. Effective 16th June, 2006 government reduced customs duty on petrol and diesel from 10 to 7.5 percent in line with recommendations made by Rangarajan Committee. Effective 1st March, 2007, the ad-valorem rates of excise duty on petrol and diesel have been revised from 8 to 6 percent.

The cost of a refined product consists of about 90-95 percent crude cost and 5-10 percent refining cost. The steep rise in global oil prices during 2004-05 had increased the burden on refineries. The global prices of crude oil and petroleum products have remained high and volatile until 2008. The phenomenal increase in price of crude oil and petroleum products in the International market assumed alarming proportions.

Most studies that examined the impact of fuel tax policies on the consumers have found that the taxes are regressive in nature. However, Datta (2008) argues that this need not be the case. His analysis shows that for an environmental tax to be effective, the fuel should have elastic demand and high emission potential. Transport fuels satisfy both these conditions and are progressive. Thus, there is an appropriate case for a fuel tax. Their emission potential is around 2.3 kilograms of carbon dioxide per litre of fuel. Different studies have found transport fuel elasticity to be -0.84 and -0.42, both of which values are price sensitive.

Coal an important input for power generation in India has high ash content thereby causing serious environmental pollution, health hazards in transportation and handling, and industrial applications. It is observed that 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 Expert Committee (2007) under the Chairmanship of T.L. Sankar submitted Part I of their Report in December 2005 and Par II Report in 2007 had observed that the environmental issues with respect of coal projects should be taken up on priority consideration by the government. Also, planned imports of coal are to be encouraged and all domestic coal that is not earmarked for the power sector should be brought into e-auction, and 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 consumers 80 percent of the domestic production and the quality of coal that it consumes is not easily saleable to the steel and cement sectors.

The coal royalty rates were fixed way back in 1971 and were revised in 1975, 1981, 1991, 1994, and 2002. Thereafter, the Government revised the royalty rates on coal and lignite w.e.f 01.08.2007 on the basis of a formula consisting of ad-valorem plus a fixed component. The royalty rates are a combination of specific and ad-valorem rates. This royalty revision is likely to give to the States an increase of about 23-24 percent in revenue.

Since 2003, a cess is being collected by the Coal Commissioner on coal 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 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. Also, the carbon emissions and surface pollution are high in some 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.

Appendix 6

RECOMMENDATIONS OF EARLIER ECO TAX STUDIES

Earlier studies have closely looked into some of the highly polluting inputs and outputs and recommended the use of appropriate market instruments - eco-tax rates and subsidies – to limit or at least reduce the rate of pollution. The following paragraphs provide a brief review of earlier recommendations.

6.1 Coal

The MSE (2007) study recommended the levy of an eco-cess to provide suitable incentives for reducing the ash-content. The additional burden of the cess measured in terms of percent of base price of different grades of both coking and non-coking coal was also estimated. MSE (2008) recommended a similar but somewhat simplified structure of the eco-cess as given in Table A6.1.

Table A6.1: 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

It was proposed that the existing provision of collecting a uniform cess of Rs. 10 per tonne of coal be applied to levying an environmentally rational cess which will be passed on to the consumers. This 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 receipt from the cess was proposed to be allocated for setting up facilities for washing and treating coal and related research and development.

6.2 Petroleum products

As part of the overall tax reforms, it was suggested that

i. 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;

ii. Considering the revenue-importance of this tax, in order not to have detrimental effects either on growth 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.

6.3 Chemical fertilizers

Given the large volume of subsidies 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 total exemption and 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.

6.4 Chemical pesticides

In order to discourage the use of chemical pesticides, an effective pricing policy would be to levy an eco-tax on chemical pesticides based on toxicity levels. It was recommended that the tax should be a separate eco-cess which could be levied on the pesticide manufacturers. The yield from the cess could be used to promote the use of biopesticides and integrated pest management.

An additional cess based on toxicity of chemical pesticides, could be collected as an eco-tax. The Central Insecticides Board has designated a colour coding based on toxicity. This code could be used as a basis for levying the eco-cess (Table A6.2).

Table A6.2: Rates of Eco-cess on chemical pesticides

Toxicity	Colour	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

Keeping in view the MSE (2007) study, the MSE (2008) study recommended that:

i. Chemical fertilizers be placed at 14 percent under CENVAT and at 12.5 percent under State VAT.

ii. CENVAT on bio-pesticides be decreased from 16 percent to 8 percent and it should be put under the exempted category in State VAT.

6.5 Plastics

Plastic products like carry bags, beverage containers and thin sheets cause significant solid waste problems. There is a concern that recycling may not be environmentally safe. The studies recommended the following:

1. *Biodegradable Plastics*: The 16 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.

6.6 Automobiles

As the proposed eco-tax directly targets the fuel consumption of vehicles it may be more appropriate to call it a resource tax. In addition to conservation of the exhaustible resource, the resource tax will reduce the emissions of local pollutants and global pollutant ($C0_2$). The proposed resource tax rates for two-wheelers, passenger cars and jeeps are given in Table A6.3. The bases of resource tax would be the prices of various categories of vehicles before CENVAT.

Table A6.3 : Rates of Resource Tax

Vehicle	Fuel Economy	Resource Tax Factor	Rate of Resource Tax (percent)
Two-wheelers	0-40	1.50	3.0
	41-50	1.33	2.5
	51-60	1.09	2.0
	61 & >	1.00	-
Passenger Cars/Jeeps	<10	1.67	5.0
	10-14	1.25	3.0
	12-18	1.11	2.0
	>18	1.00	-

The MSE (2007) study recommended an annual emission tax of Rs.750 on diesel cars based on estimates of income loss and medical costs attributable to particulate matter.

6.7 Pulp and paper

Pulp and paper mills as well as viscose rayon mills could be encouraged to move towards chlorine substitutes like hydrogen peroxide. It was recommended that:

i. The rebate on the basic excise duty (BED) of 16% on chlorine in the VAT system be withdrawn. The additional excise revenue would be of the order of Rs. 5.3 crore for pulp and paper plants and about Rs. 0.65 crore for viscose rayon plants or a total of about Rs. 6 crore per year
ii. Provide incentives to switch over to chlorine substitutes by continuing to provide rebates on such substitutes (even if they contain chlorine) like chlorine dioxide or hypochlorite
iii. An accelerated depreciation (at the rate of 50 percent) be provided to promote investment in new machinery

6.8 Phosphate based detergents

In line with the precautionary principle, it is desirable to limit the use of phosphates in detergents, even though there is not much information on the impact of phosphate based detergents in India. The major input in detergents which contributes to the phosphate content is sodium tri-poly phosphate (STPP). In order to limit the use of phosphates in detergents, it is recommended that:

i. The rebate of the CENVAT levied on the phosphate compounds used as inputs (such as STPP) can be denied. At a 16% excise duty this would imply an additional revenue of Rs, 32 crore to the Government.
ii. Non-phosphate detergents could be promoted by decreasing the excise duty from 16 percent to 8 percent which would be revenue negative. It was estimated that such reduction in excise duty would result in a revenue loss of about Rs. 28 crore.

6.9 Lead acid batteries

In order to check the proliferation of battery re-building and smelting activity in the unorganized sector and to improve the competitiveness of licensed recyclers vis-à-vis informal sector smelters the following recommendations were proposed:

i. reduction in excise duty on production of secondary lead by the organised smelters
ii. levy of an environment cess on the sale of scrap batteries in auctions by the bulk consumers. The environment cess should be allowed to be set off against the levies on production of secondary lead. This could be expected to check the participation of the unorganised smelters/traders in auctions.

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