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## **SUMMARY AND RECOMMENDATIONS**

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### 5.1 The energy sector

Until recently enterprises in coal, petroleum and electricity (with a few exceptions) had public statutory monopoly status. This environment enabled the central and state governments to use the public prices to achieve goals other than efficiency as for example, equity and regional development. In the petroleum group, gasoline and aviation turbine fuel were heavily taxed while kerosene, diesel, LPG for household use and naphtha for fertilizer use were heavily subsidised, but the group as a whole reported reasonable returns on the investments. In the power sector, in 1994-95 the average cost of electricity was Rs 1.62 per kwh while the average revenue was Rs 1.30 per kwh; the average revenues per kwh were Rs 0.22 in agriculture, Rs 0.88 in domestic, Rs 1.91 in commercial and Rs 2.02 in industrial categories. The state electricity boards earned a negative rate of return of -13.5 percent on the capital employed. The estimated subsidy for agricultural and domestic categories was Rs 133 billion in 1994-95.

The economic reforms introduced in June 1991 were triggered mainly by the growing deficit of the central government.

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Owing to the resource crunch, both central and state governments could not find adequate resources to finance investments in this sector. Hence private entry was allowed. Now the government favours the determination of administered prices of energy products on the basis of long-run marginal costs. With the passage of legislations relating to the protection of the environment, setting up of central and state pollution control boards, prescribing minimal national standards for air and water pollutants and guidelines for handling solid wastes and growing judicial activism, the need for internalising environmental costs in energy policies is obvious.

Against this background, this study explores the design and implementation of (a) prices based on long-run marginal social costs (LRMSC) (b) carbon emission tax and examines the effects of these proposals on energy demand and improvements in the environment.

### **Price reforms**

The estimates of LRMSCs of electricity are based on normative costs of a relatively clean thermal power plant which uses washed coal with ash content of 30 percent.

The capital cost per kwh ranges from Rs 1.19 for EHT category to Rs 6.24 for LT agricultural category, the corresponding variation in energy cost being Rs 1.11 to Rs 1.38. The combined cost per kwh varies from Rs 2.30 per kwh for HT continuous process industries to Rs 7.62 for LT agriculture. An immediate switch to the proposed tariff would generate a surplus at 1994-95 level of consumption of Rs 834 billion per year. The ratios of tariffs in 1994-95 to the LRMSCs range from 0.03 in LT agriculture to 0.87 in continuous processing industries.

An immediate switch to LRMSC based tariff involves very steep increases in prices for households and agriculture and hence it

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is politically infeasible. Taking into account the equity aspects and the low penetration of electricity in rural areas, phased increases can be recommended till 2001–02, and contain per unit subsidies at the rates of 33.33 percent of the LRMSC for LT industry and 50 percent of the LRMSC for small farmers and small domestic consumers even in 2001–02.

With the phased implementation of the proposed tariffs, the annual rates of growth of electricity consumption can be reduced from 6 percent per annum during 1994–95 and 2001–02 to 4.53 percent if the own price elasticity of demand is  $-0.20$ , and to 3.75 percent if the price elasticity of demand is  $-0.30$ .

The proposed price reforms for coal and petroleum products are based on the cost, insurance and freight prices of imports of the commodities. In the coal sector, the ratios of pithead prices of coal to the economic prices ranged 0.97 and 1.38. The price reforms will result in price increases for coking coal and washed non-coking coal. For the sector as a whole, setting coal prices equal to their economic costs would not result in any significant increase in revenue.

In the petroleum sector one can observe a wide variation in the ratio of the retail prices to the economic prices with tax in 1994–95. The ratio was only 0.46 for kerosene and 3.15 for gasoline. When subsidy as the difference between the economic cost and the price is measured, the subsidy for kerosene alone is Rs 35.67 billion for 1994–95. The ration price of kerosene has been frozen at Rs 2.55 per litre but its price in the open market is Rs 8.10. The price of the LPG cylinder in the open market is 75 percent higher than the ration price.

### **Carbon emission tax**

A carbon emission tax based on the carbon emission factors for coal, petroleum and natural gas is proposed. Two tax rates of \$5 (Rs 157)

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per tonne of CO<sub>2</sub> and \$10 (Rs 314) per tonne of CO<sub>2</sub> are considered.

With an emission factor of 1.46 tonne, a tax at the rate of Rs 157 per tonne of CO<sub>2</sub> will increase the pithead price of coal by 72 percent. The estimated tax revenue, at the 1994–95 level of consumption, is Rs 38.24 billion. The landed price of coal for a plant located 1000 km away from the coal mine will increase by 18 percent. For both coking and non-coking coal, as a result of the tax, the pithead price of coal will increase by 61 percent. The anticipated revenue from the tax, at 1994–95 level of consumption would be Rs 79.25 billion.

With a tax at the rate of Rs 157 per tonne of CO<sub>2</sub> the average price of crude oil will increase by 10.2 percent and the anticipated tax revenue, at the 1994–95 level of consumption, would be Rs 23.39 billion. With the same tax rate, the price of natural gas will increase by 13.35 percent and the anticipated tax revenue would be Rs 5.668 billion.

With an imposition of carbon emission tax at the rate of Rs 157 per tonne of CO<sub>2</sub> from 1994–95 the rate of increase in CO<sub>2</sub> emissions from coal use during the period 1994–95 to 2001–02 can be reduced from 82.8 percent to 76.7 percent. If all coal based plants are required to use washed coal with an ash content of 30 percent or less, the annual rate of emissions can be reduced from 8 percent to about 6 percent.

The effects of the carbon tax on the emissions from the use of petroleum and natural gas are rather small. Between 1994–95 and 2001–02, the reductions in the rates of emissions during the whole period would be only 1 percent.

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## Other reforms

There is an urgent need for depoliticising the determination of energy prices. The central government stressed the need for an independent and transparent Tariff Commission to fix the prices as early as in 1991 but it has been created so far. The government must create such a body.

The information system for pricing must change from an accounting cost based cost allocation exercise to the one based on the social costs. The government should provide technical and institutional support for popularising clean technologies, energy conservation, cogeneration, introduction of time-of-day meters for large users of electricity.

With the opening up of the energy sector to private enterprises, there is an urgent need for structural reforms of the public enterprises. They should be given autonomy and be made accountable. If subsidy or cross subsidy for a consumer category is desired in the public interest, then both the private and public enterprises must bear the cost of social obligations.

## 5.2 Urban water supply

The per capita water availability in 1992-93 varied between 47 litres per capita per day (lpcd) in Madras to 237 lpcd in Delhi. In Delhi, the quantity consumed in 1992-93 varied between 313 lpcd by the affluent consumers to 140 lpcd by the urban poor and to a mere 16 lpcd by the slum dwellers. Many cities and towns provide water supply for one or two hours per day during normal periods and only one or two hours twice a week during lean periods. The intermittent supply and inefficient pressure keep the pipe system in many areas empty for larger duration.

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Sipahimalani (1995) provides estimates of cost of water per kl as Rs 0.95 in Bombay, Rs 1.70 in Delhi, Rs 5.00 in Hyderabad and Rs 2.94 in Madras. The estimated unit costs for new sources are around Rs 15 per kl.

Free distribution of water is done through public standposts or hydrants. Consumers who get water through pipelines come under metered and non-metered categories. For metered category, the charge system consists of a fixed charge and a unit charge based on the number of taps. Non-metered charges consist of a tax and water benefit tax, both based on rateable property value.

Sipahimalani (1995) finds that it is only in Bombay that the average revenue per kl is close to the average cost; here domestic consumers are cross-subsidised by other consumers. In Hyderabad, the cross subsidy to the domestic category was Rs 11.28 million per month and the overall subsidy was Rs 6.146 million per month.

There is an urgent need for structural and price reform in the water delivery system. Except for the poor, there is no justification for providing water at zero or very low price. The poor consumers should be targeted and they should be provided at least 40 lpcd of water. For all other consumers water charges should be based on meter readings. The Hyderabad experiment in modernisation and upgradation of water connections with tamper-proof meters deserves recognition. It involves a one time investment of Rs 10,000 per connection and at a 12 per cent rate of interest, this amount can be recovered on the basis of a monthly charge of Rs 52 per connection over a period of 10 years. Installation of a meter and introduction of a charge system where the charge reflects the marginal cost of water can bring not only more revenue to the boards but also help conserve water use.

This study estimates the price elasticity of demand for water

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at -0.21. The relatively low value is due to factors such as absence of any close substitute for water, supply constraint and small observed variations in the prices. At higher prices, excess demands will decrease and demand would become more elastic. Hence setting prices right would not only generate funds for financing investments but also encourage conservation of water.

There is also ample scope for improving efficiency in the supply side. In Bombay the distribution loss (between the city reservoir and the consumers, including leakages and illegal tapping of water) is estimated at 20 per cent. The transmission losses in Madras, Hyderabad and Delhi are much higher owing to the importation of water from distant sources. The revenue loss owing to water losses in Delhi in 1993-94 is estimated at Rs 434.37 million.

Urban India is, by and large, deficient in infrastructure to provide adequate facilities for huge quantities of waste water and sewage. It is only in Bombay that the expenditure on sewerage and drainage exceeds its income. At present there is no user charge. The sewerage tariffs are fixed as a percentage of water charge for metered users and as a percentage of rateable value of real property for non-metered users.

### **5.3 Solid waste services**

Indian cities currently produce waste in the aggregate of 100,000 to 110,000 tonnes, or a per capita average of 0.40 to 0.42 kg a day.

Solid waste collection, treatment and disposal are a statutory responsibility of municipal governments. While environmental standards have been set for water and air quality in specific and general environmental laws, there exists no separate legislation for solid waste management.



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There also exists no specific charge or fee for solid waste services, implying that there is no relation between the waste generated and what the waste generators might pay. Apart from a general understanding that revenues generated from the general category of taxes (on conservancy, drainage, sanitation etc., which are levied as surcharges on taxes on property and land), will be used for the provision of solid waste services, nothing else is known about their financing. Consequently, several critically important financing aspects, namely, the behaviour of households to alternative forms of charging, the effect of the volume or weight-based pricing on the pattern of household consumption, or of tax policies on waste generation and recycling, remain grey areas in this context.

The cost data on solid waste relate primarily to establishment, repairs and maintenance, materials, and miscellaneous components. Landfill or the dumping site costs are not included in the cost data; nor are the other indirect costs particularly as these relate to depletion costs associated with landfill. The cost per tonne would be higher if the municipal governments were collecting 80–90 per cent of waste, as against the current average of 60–65 per cent of the total waste.

Recognising that certain aspects of solid waste services have the characteristics of "private goods", the study outlines the financing options under two possible institutional arrangements: (i) where solid waste collection, transportation and disposal will continue to be a "public responsibility", and (ii) where these services may be provided, either in full or in part, by the private sector.

Under the assumption that it remains a public responsibility, three options are possible keeping in view the fact that the objectives are to gain environmental sustainability.

- (i) To continue with the present system of financing the services, that is, out of the general tax revenues raised by the

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- municipal governments. This option, if persisted with, will further diminish the availability of solid waste services in Indian cities and most likely, exacerbate environmental conditions arising from solid waste.
- (ii) To continue financing the solid waste services out of the general tax revenues, but introduce some basic reform measures, particularly in property taxation, so as to generate additional resources. One possible reform is to change the basis of determining the rental value of properties from that of "rents" to "square metre rates differentiated by the locational characteristics of different areas within cities". Financing solid waste services out of general taxation carries the distinct advantage of it being "equitable", in that property tax payments reflect the ability to pay.
  - (iii) To replace the indirect charging system by a direct charging system, either with a "flat fee" or a fee determined on the basis of volume/weight of waste. Direct charging has the obvious and unique advantage of being a "charge" as distinct from a "tax", and can, therefore, be used directly for achieving the objective of environmental sustainability. At the same time, charging according to volume/weight is administratively costly, prone to leakages, and difficult to administer. A "flat fee" as a direct charging mechanism is iniquitous, particularly in Indian cities where intra-city income disparities are extremely high, and where a large proportion of households—often as large as 30–40 per cent live in slums and squatter settlements.

Under the second assumption which in a sense, questions the efficiency gains of a purely municipal monopoly, the option will be to contract/sub-contract solid waste services or run the services in partnership with them, under different arrangements.

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- to permit the private sector to operate and manage the solid waste services to the extent that the private sector sets the "charge" and payment mechanism, and bears the attendant costs including those of the landfill and dumping sites.
  - to provide subsidies to the private sector in so far as these are necessary for allotting them the dumping sites and making capital investments.

Examination of these options constitute the future research agenda in the Indian context.