4. Pollution Charges, Fees, and Taxes

4.1 Introduction

A *pollution charge* is a fee based on the quantity of pollutants that are discharged into the environment. A *user charge* is a fee paid in exchange for the use of natural resources or for the collection or disposal of pollutants. A *product charge* is a fee imposed on products that are believed to have environmentally harmful effects. Although the terms “fee,” “charge,” and “tax” are used interchangeably in this chapter, there are subtle differences. Under federal law, a tax is a purely revenue-raising instrument, whereas charges or fees are intended to offset costs to the government. Thus, tax receipts would be part of general revenues. While many charges and fees that are collected must be placed in the Treasury General Fund, some are allowed to be retained and could supplement agency budgets. The different types of fees, charges, and taxes discussed in this chapter can be classified in various ways. They are summarized in Table 4-1.

Table 4-1. Fees, Charges, and Taxes in Environmental Policy

Instrument	Description	Examples
Pollution fee	Charge based on the quantity of pollutants released into the environment	Air emissions permit fees in California, Maine, other states Effluent permit fees in Louisiana, California, Wisconsin, other states Solid waste disposal fees
User fee	Fee for the use of resources	Water use fees Congestion or time-based highway tolls Grazing fees
Product charge	Charge on a product believed to have environmentally harmful effects	Gas guzzler tax CFC tax State taxes on fertilizers State advance disposal fees on tires, motor oil, packaging, other goods
Other fees on environmentally damaging activities	Various mechanisms	Wetland development fees Stormwater runoff fees

Most environmental taxes are designed primarily to raise revenue, often to fund environmental protection activities. The economic rationale behind such taxes is that those who cause pollution should bear the costs. Such costs include both damages to the environment and the administrative costs incurred by the authorities that regulate polluters. To be economically efficient, environmental taxes should reflect both of these costs.

Although some charges, especially product charges, have been imposed at the federal level, the majority of them have been introduced at the state or local level. In the case of air and water pollution, the federal government has provided policy guidance on charges, but the states have developed and implemented a wide variety of charges as they have seen fit.


Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches

Information Disclosure


Voluntary Programs

Pollution Charges, Fees, Taxes

Given the multiplicity of environmental taxes—especially at the state and local levels—and the frequency with which they are adopted or modified, this chapter does not attempt to provide a comprehensive description of all the environmental taxes in place in the United States. Rather, its purpose is to describe some of the more important environmental taxes.

4.2 Water Fees

Water fees take various forms, including user fees (e.g., for groundwater, surface water, or drinking water supplied by waterworks) and fees for direct or indirect water discharges. Indirect discharges are sent to treatment works. The rationale for water user fees is that water is not a free resource but rather a scarce commodity that should be priced to avoid inefficient use and related environmental problems. The rationale for discharge fees follows from the polluter-pays principle described in the previous section. Most water fees are intended primarily to raise revenue to recover the costs of providing service rather than to allocate a scarce resource among competing interests.

4.2.1 Indirect Discharge and User Fees

Fees are imposed on households and businesses for discharges of wastewater into Publicly Owned Treatment Works (POTWs). Frequently, the water and wastewater utilities that service a household or business are one and the same. When a single invoice includes both services, users may be able to distinguish discharge fees from water user fees only by careful attention to line items. Wastewater discharges are not directly metered in most cases; rather they are assumed to be equal in volume to water consumption, which is measured. Some discharge fees for larger businesses are based not only on water use but also on discharge toxicity, which provides them with a separate incentive to reduce the toxicity of their discharges. Sims found that toxicity-based charges provided an incentive for large industrial facilities to reduce the volume of their discharge.[29]

With respect to water user fees, EPA's 1995 Community Water System Survey estimated that 95% of residential water customers and 98% of nonresidential water customers are metered. They pay water charges based directly on their usage.[30]

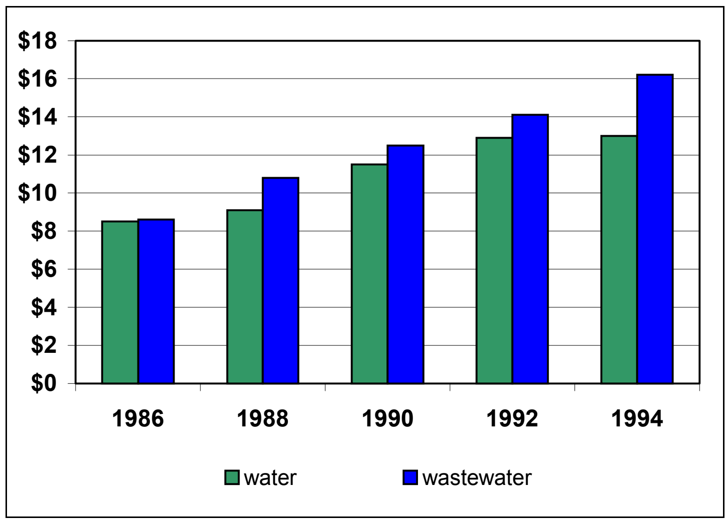
Whether a water user fee has a greater effect in terms of raising revenue or reducing a potentially polluting activity depends largely on the elasticity of the demand for water, that is whether demand is responsive to changes in price. If the demand is inelastic, an increase in user fees will raise revenue. User fees will not, however, affect consumption behavior in a significant way. If demand is elastic, however, consumption behavior is likely to be changed by a water fee, but the revenue-raising prospects are limited. Although water demand is often assumed to be inelastic, studies that separate water demand by season have found that household water demand is inelastic in winter but elastic in summer. Others have found that water demand by industrial and agricultural users is sensitive to price changes.[31]

To promote water conservation, many have suggested the use of rate schedules that impose higher rates per 1,000 cubic feet as use increases. Two periodic surveys give an indication as to the type of rates that water utilities use. The Ernst & Young survey focuses on only the largest urban utilities, while the EPA Community Water System Survey is a more comprehensive, random-sample survey that includes smaller utilities. The Ernst & Young survey of residential rates for about 130 utilities reported that 38% use decreasing rates, 37% use uniform rates, and

22% use increasing rates. It also shows two trends over time: a greater use of increasing rates and a lesser use of decreasing rates. EPA's Community Water System Survey obtained residential rates from more than 1,000 systems: 49% use uniform rates, 16% use decreasing rates, and 11% use increasing rates. Since utilities could report more than one type of rate per class of customer, the total for all rate types is more than 100%. Taken together, these two surveys suggest that smaller utilities in general are less likely to use increasing or decreasing rates than larger utilities.

As shown in Figure 4-1, periodic surveys of selected water utilities indicate that water and wastewater fees have risen significantly since 1986. These price increases have exceeded the rate of inflation. In addition, EPA's Community Water System Survey notes the tendency for large utilities to raise rates more frequently than small utilities. Smaller utilities raise rates by a greater amount when they do raise rates, but the differences are less dramatic when reported in annualized terms.

Figure 4-1. Water and Wastewater Charges (monthly average)



Source: Ernst & Young. 1994. p. 3

In addition to water and wastewater charges, stormwater charges have been imposed in a number of areas. Ernst & Young found that the number of utilities with such charges increased significantly from 1992 to 1994. Their use varies significantly across regions: They are used by over half of all utilities surveyed in the West but by none surveyed in the Northeast. In some areas, reduced storm-water fees are assessed in return for measures that promote stormwater management.

Finally, in some states, water user fees generate revenues for drinking water programs. New Jersey, for example, raises $2.8 million annually (out of a total drinking water program budget of $5 million) from a water use tax of $0.01 per 1,000 gallons.[32]

4.2.2 Direct Discharge Fees

The Federal Water Pollution Control Act of 1972 provides for the regulation of point- source discharges through a system of national effluent standards that are promulgated by EPA. All point sources must obtain National Pollution Discharge Elimination System (NPDES) permits in order to discharge effluent.[33] By August 2000, EPA had authorized 43 states to issue NPDES permits.[34] In two states, EPA regional offices issue the permits. As of July 1995, about 59,000 municipal and industrial facilities in the United States had received NPDES permits.[35]

A 1993 survey revealed that 39 states assessed NPDES permit fees as of December 1993. In 10 of the states, fees varied according to discharge volume and toxicity, while in 18 other states fees varied according to discharge volume alone (see Table 4-2). Other criteria sometimes used in setting fees include the purpose of the water use, the characteristics of the receiving water, and the type of facility releasing the discharge. Some states use point or class systems with various criteria to determine the fee levels for different dischargers. Fees for Publicly Owned Treatment Works (POTWs) are sometimes based on the size of the population that is presumed to be connected to the local sewage system.

Table 4-2. State Effluent Permit Fee Structures

Fee Structure	States
Flat or varies only according to industry or size of permit holders.	Alabama, Alaska, Delaware, Hawaii, Kentucky, Maine, Massachusetts, Pennsylvania, Rhode Island, Utah, Virginia
Varies according to discharge volume	Arizona, Arkansas, Colorado, Connecticut, Florida, Kansas, Minnesota, Missouri, Nevada, New York, North Carolina, Ohio, Oregon, South Carolina, South Dakota, Tennessee, Vermont, Washington
Varies according to discharge volume and toxicity	California, Indiana, Louisiana, Maryland, Montana, New Jersey, Oklahoma, Texas, West Virginia, Wisconsin

Source: Duhl. 1993, p. 10.

The primary purpose of NPDES permit fees is to raise revenue, especially for the permitting program. This rationale explains why fees are often based on the complexity of the permit, a reflection of the administrative effort required to get the permit in place. In a number of states, fees are set to attain revenue targets.

A secondary purpose is to discourage water pollution. Although the incentive effect of water effluent fees in the United States has not been studied in a comprehensive way, several factors limit the likelihood of a strong impact. In some cases, fees are based not on measured discharge characteristics but rather on more easily measured parameters that are related to discharge characteristics. Moreover, some fee structures have broad classes for characterizing discharge volume, toxicity levels, or both. These structures impose the same fee within a given volume or toxicity class In such cases, polluters have no incentive to limit discharges unless they can move from one fee class to another. Finally, the charges are often modest relative to control costs. New Jersey has the highest effluent fees. In 1993, two facilities in New Jersey paid $702,812. In most states, however, the highest fees are less than $100,000. As a point of comparison, effluent control costs typically exceed $5 million each year at a large industrial facility.

4.2.3 Some State Effluent Permitting Fees

Although it is beyond the scope of this report to describe water effluent fees for all 50 states, examples from Louisiana, California, and Wisconsin should illustrate typical characteristics of these fees. Each of these states has NPDES permit fees (i.e., effluent fees) that vary with both the volume and toxicity of the discharge.

Louisiana uses water permit fees to fund not only the state permit program but also the activities of the Office of Water Resources of the Department of Environmental Quality. (The legislature no longer provides general revenues to the Office.) The annual permit fee is determined by a worksheet that assigns points on the basis of several factors: (1) facility complexity; (2) flow volume and type; (3) pollutants released; (4) heat load; (5) potential public health threat; and (6) the designation of a facility as major or minor, depending upon how many people it employs. The points are multiplied by a rate factor of $97.50 per point for municipal facilities and $170.63 per point for industrial facilities to determine total annual fees. The minimum annual fee is $227.50, and the maximum annual fee is $90,000. In addition to annual fees, Louisiana imposes application fees for new, modified, or reissued permits. In most cases, these fees are 20% of the annual fee.[36]

In California, NPDES annual fees are based on the threat to water quality and the complexity of the permit. There are three categories for each characteristic: Categories I, II, and III for the level of threat to water quality; and Categories a, b, and c for the complexity of the permit. Permit holders with a I-a rating (the greatest threat to water quality and the most complex permits) pay the highest fees, $10,000 a year. III-c permit holders pay the lowest fees, $400 a year. These fees fund State Water Board programs.

In addition to the NPDES permit fees, California charges Bay Protection and Toxic Cleanup fees. This fee structure is similar to that of the NPDES permits except that it is also applied to other sources of pollution such as storm drains, boat construction and repair facilities, marinas, dredging operations, and beach replenishment activities. Another difference is that its revenues fund the Bay Protection and Toxic Cleanup Program, which is designed to identify hot spots, develop a water quality database, and help coordinate water policy. The Bay Protection Fee schedule ranges from $300 for III-c permittees (who pose the least threat to water quality and have the least complex permits) to $11,000 for I-a permittees. Dredging operations are charged an annual fee of up to $15,000.

The Wisconsin effluent fee system is believed to have potential incentive effects. The fee rate per pound of individual pollutants is inversely related to the permit limit in pounds for the pollutant. Thus, the most harmful pollutants are taxed at the highest rate per pound. Pollutant loadings are calculated on the basis of flow and concentration information contained in wastewater monitoring reports. Polluters are thereby encouraged to reduce both the quantity and the toxicity of pollutant releases.

4.2.4 Stormwater Runoff Fees

It is common practice for counties to impose fees on real estate developments based on surface area runoff (paved areas and areas under roof). Fee revenues are used for storm-water management in stream valleys. These fees differ from the utility stormwater fees described in Section 4.2.1 in that they apply to runoff into surface water.

4.3 Air Emission Fees

As is the case with water pollution, there are no national air emissions fees. However, the Clean Air Act Amendments of 1990 require that states impose fees for issuing emission permits. The Amendments also impose fees on VOC emissions that will come into force in 2005 and 2010 in areas that fall far short of attaining national ambient air quality standards for ozone. States have been more active in the use of emission fees as an air quality management tool.

4.3.1 Permit Fees

The 1990 Clean Air Act Amendments require that states impose permit fees to recover the administrative costs of their EPA-approved operating permit programs. The Amendments set the minimum presumptive level for such fees at $25 per ton of emissions of air toxics and criteria air pollutants (excluding carbon monoxide). They also specified that this amount should be adjusted for inflation. Each state is required to set fees that completely cover operating permit program costs. If the fees are greater than or equal to $25 per ton, adjusted for inflation—at present, about

$35 per ton—EPA assumes that the fees are adequately high. States with lower fees must present detailed evidence that fee revenues are sufficient to cover their operating permit program costs. Several state permit programs have been denied full EPA approval because they have submitted insufficient information on the adequacy of their fees. These states have received interim approval, pending their submission of evidence of fee adequacy.

Although states can meet the revenue-raising requirement through flat fees or other types of fees, most have chosen incremental per-ton fees. Some states base their fees on the pollutant's potential harm to the environment. New Mexico, for example, levies fees of $150 per ton for air toxics but only $10 per ton for criteria pollutants. Fee structures in Maine and California are discussed here for illustrative purposes.

4.3.1.1 Air Emission Permit Fees in Maine

In November 1993, Maine raised its air emission permit fees. Charges were raised from $2 per ton to $5 per ton for emissions up to 1,000 tons; from $4 per ton to $10 per ton for emissions between 1,001 and 4,000 tons; and from $8 per ton to $15 per ton for emissions in excess of 4,000 tons. The minimum charge rose from $100 to $250, and the maximum charge rose from $100,000 to $150,000. The fees apply to emissions of sulfur oxides (SO_x), NO_x, VOCs, and particulate matter. Having since been adjusted for inflation, their fee levels (as of 1997) are shown in Table 4-3. The fees applied to all permit holders.

Table 4-3. Air Emissions Permit Fees in Maine

Amount Emitted	Fee ($/ton)
Up to 1,000 tons	5.28
1,000-4,000 tons	10.57
More than 4,000 tons	15.85

Source: Limouze, Maine Air Quality Bureau.

Maine has also imposed an air quality surcharge based on the toxicity of emissions. The magnitude of the surcharge is determined on the basis of several criteria. Approximately 85 facilities are subject to the tax, which is capped at $50,000. Before the surcharge was adopted, the Director of Maine's Air Quality Bureau said that the state would give polluters an incentive to identify how they would reduce their emissions of the most toxic substances.[37] The same Air Quality Bureau official indicated that surcharge revenues have fallen and that the surcharge has had a slight incentive effect. The official also suggested that the impact on the environment is difficult to isolate from other potential factors, such as the Toxics Release Inventory. Permit fees produce approximately $1.8 million in revenues each year, and toxicity surcharges net $0.6 million in annual revenues. Revenues are used for the air permit program and other air quality activities.

4.3.1.2 Emission Permit Fees for South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD), located in Southern California) levies the highest fees per unit of air emissions in the United States. The fees shown in Tables 4-4 and 4-5 are adjusted for inflation and budgetary needs of the SCAQMD every May.

Facilities that temporarily exceed their allowable emissions levels must pay excess emissions fees. For most pollutants, the excess emissions fees are about the same as the regular fees. For carbon monoxide, however, they are approximately twice as high. In addition, SCAQMD imposes fees for visible emissions and various administrative procedures.[38]

Table 4-4. Emission Fees in SCAQMD

FY 99–00, $ per ton

Annual Emissions	Organic Gases	Nitrogen Oxides	Carbon Monoxide	Sulfur Oxides	Particulate Matter
4–25 tons	$292.80	$171.30		$203.10	$223.90
25–75 tons	475.40	272.10		328.30	362.80
>75 tons	711.60	409.80		492.90	543.20
>100 tons			$3.50		

Source: SCAQMD Rule 301.

Fees for some air toxics have escalated rapidly, far faster than the fees for criteria air pollutants. Between 1996 and 2000, emission fees for asbestos; cadmium; hexavalent chromium; chlorinated dioxins; 1,3 butadiene; and lead rose by 50% to more than 100%.

Table 4-5. Air Toxics and Ozone-Depleting Chemicals Emission Fees in SCAQMD

Pollutant	$ Per Pound		
	FY96–97	FY98–99	FY99–00
Asbestos, cadmium	2.17	3.00	3.40
Benzene, carbon tetrachloride, ethylene di-bromide, ethylene dichloride, ethylene oxide	0.90	1.00	1.13
Methylene chloride	0.05	0.05	0.06
Hexavalent chromium	2.67	4.00	4.53
Chlorinated dioxins and dibenzofurans	3.17	5.00	5.66
Nickel	1.67	2.00	2.26
1,3-Butadiene, inorganic arsenic, beryllium, poly-nuclear aromatic hydrocarbons (PAH)	1.50	3.00	3.40
Lead, vinyl chloride	0.50	1.00	1.13
1,4-Dioxane	0.11	0.21	0.23
Formaldehyde, perchloroethylene	0.21	0.21	0.23
Chlorofluorocarbons	0.18	0.18	0.20
1,1,1-trichloroethane	0.038	0.04	0.04

Source: SCAQMD Rule 301

Given the presence of traditional forms of regulation and other factors that might influence air pollutant emissions, the incentive effect of the SCAQMD emissions fees is difficult to determine. In most cases, these fees are lower than the marginal costs for pollution abatement. The main purpose of these fees is to recover the administrative costs of SCAQMD's activities.

4.3.1.3 California "Hot Spots" Fees

The California Air Toxics "Hot Spots" Information and Assessment Act (AB 2588) requires facilities to report the type and quantity of certain substances they release into the air. The California Air Resources Board (CARB) administers the program. The law also requires CARB to develop and adopt fees to cover the administrative costs of the program that are incurred by CARB and local air districts. Districts can either set their own fees or request that CARB set fees for them. Each district is responsible for billing and collecting the fees and remitting the district's share of state costs to CARB. The information component of this law is discussed in Chapter 9. The fees are discussed in this chapter.

CARB's Hot Spots fee structure, which is used in 12 of California's 34 air pollution control districts, is no longer based on tonnage of emissions. However, at least two of the 22 districts that set their own fees base them on the amounts and toxicity of pollutants. One district bases its fees on amount but not toxicity. The toxicity-based fee structure of the Bay Area Air Quality Management District (BAAQMD) is described here as an example.

BAAQMD bases fees on Unit Risk Values (URVs) for carcinogen emissions and Acceptable Exposure Levels (AELs) for other emissions. Fee amounts depend on the quantities of weighted emissions. For carcinogens, weighted emissions are determined by multiplying the amount of each substance by 100,000 times its URV. For other toxics, weighted emissions are determined by multiplying the amount of each substance by the reciprocal of its AEL (in m^3/micro-gram). The sum of the weighted emissions of all toxics is multiplied by a coefficient to calculate the fees charged to each source. The coefficient varies from year to year depending on the costs incurred by CARB and BAAQMD to manage the Hot Spots program.

Facilities with fewer than 50 weighted pounds pay nothing, while facilities with weighted emissions between 50 and 1,000 pounds pay a flat fee of $125. For gasoline dispensing facilities, the fee is simply $5 for each dispensing nozzle. For small businesses, which are defined as having no more than 50 employees and $5 million in annual receipts, fees are capped at $5,000. Government facilities are also subject to the fees. Although there is no maximum fee for larger businesses, no source has paid more than $60,000 in annual fees. In 1992, about 1,200 facilities paid $1.16 million in fees.

A total of 81 toxics are subject to the fees. In most cases, emissions are not measured but rather estimated on the basis of two factors: data on the use of toxics and emissions factors that depend on the abatement equipment. Although fee amounts appear relatively small for larger businesses, BAAQMD officials believe that the fees have contributed to a decrease in toxic emissions. Facilities have lowered emissions in various ways, including process changes and reductions in the use of toxics. When toxicity-based fees were adopted in 1992, for example, hospitals and metal plating facilities emitted relatively large amounts of ethylene oxide and hexavalent chromium. Since these substances have high URVs, emitting facilities faced high fees. Most of these facilities installed Best Available Control Technology soon after the BAAQMD fee structure was adopted.[39]

However, it is difficult to isolate the effects of these fees from other factors that could influence toxic emissions, including the information and reductions planning components of the Hot Spots program and federal Toxic Release Inventory requirements. In addition, refineries have made large investments to comply with the reformulated fuel and fugitive emissions standards.

4.3.2 Ozone Non-attainment Area Fees

The 1990 Clean Air Act Amendments impose fees on "excess" VOC emissions in ozone non-attainment areas designated as "Severe" or "Extreme." The fees are set at $5,000 per ton (adjusted for inflation since 1990) for each ton emitted in excess of 80% of a baseline quantity. The fees come into effect on the applicable attainment date for the area: 2005 for areas with the designation Severe and 2010 for areas designated as Extreme. (In 1990, California's South Coast

Air Quality Management District was the only non-attainment area rated as Extreme. At present, there are no areas that have that classification.)

4.4 Solid Waste Disposal Fees

This section briefly discusses variable rate programs (a relatively new trend in household waste collection), landfill taxes, and hazardous waste disposal taxes. The purpose of such disposal taxes is to discourage waste generation and encourage recycling. Unfortunately, they also create incentives to dispose of waste illegally or to transport waste to other locations where disposal is cheaper.

4.4.1 Variable Pricing Programs

Communities throughout the United States have traditionally levied fixed collection fees for household waste, or they have included collection and disposal costs in property taxes. Such pricing practices are inefficient in that the marginal price of solid waste disposal faced by the household is zero, whereas the marginal collection and disposal cost is positive.

However, a growing number of communities are now charging for solid waste collection based on the volume generated by the household. Such variable rate (or "pay-as-you-throw") programs have been implemented in more than 4,100 communities in 42 states, reaching an estimated 10% of the U.S. population. Four states have mandated the use of variable rate programs in some or all of their municipalities. Washington's law applies mostly to private collectors that operate in unincorporated areas of the state, but virtually all municipalities in the state use variable rates. Iowa and Wisconsin require variable rates only in communities that fail to attain a 25% waste recycling/diversion goal by certain deadlines. In Minnesota, variable rates are required in all communities.[40] EPA is also encouraging variable rates, and the Agency has held a series of workshops to explain their advantages and disadvantages and to provide information on how to implement them.

Variable rate programs can take several forms. Prepaid garbage bags or stickers that affix to bags can be required for collection, or collection fees can be based on the number of cans, the size of cans, or both of these characteristics. A small number of communities have weight-based systems. More common are mixed programs that combine a fixed rate—which in some programs entitles households to collect a pre-specified amount of waste—and incremental rates for amounts in excess of the maximum covered by the flat rate. Such mixed programs are growing in popularity, perhaps because they are relatively easy and inexpensive to implement, they provide a stable source of revenue for collection services, they have the potential to reduce illegal dumping, and they offer a pre-specified level of service at a fixed cost to many customers.[41] However, according to one source, collection systems that require periodic billing of customers are likely to be more expensive to administer than bag or sticker systems.[42] On the other hand, one disadvantage of using bags is that they can tear, especially if handled improperly or opened by animals. Table 4-6 describes variable rate structures in a number of U.S. communities studied by Miranda and Aldy and Bauer and Miranda.

Waste collection systems can be open systems or exclusive franchises. In open systems, the city may provide optional waste collection (e.g., Grand Rapids, Lansing), or it may leave collection completely in the hands of private firms (e.g., Colorado Springs). In exclusive franchises, collection can be done either by the city (e.g., Spokane, Tacoma) or by one or more contracted

Table 4-6. Variable Rate Structures

Community	Fee Structure
Glendale, CA	65-gallon cart: $6.45/month, 2¢/gallon 100-gallon cart: 10.10/month, 2¢/gallon
Pasadena, CA	60-gallon cart: $10.41/month, 4¢/gallon 100-gallon cart: 16.23/month, 4¢/gallon 2 60-gallon carts: 19.01/month, 4¢/gallon 60-gallon & 100-gallon carts: 22.40/month, 4¢/gallon 2 100-gallon carts: 28.62/month, 3¢/gallon
San Jose, CA	32-gallon cart: $13.95/month, 10¢/gallon 64-gallon cart: 24.95/month, 10¢/gallon 96-gallon cart: 37.50/month, 10¢/gallon 128-gallon cart: 55.80/month, 10¢/gallon
Santa Monica, CA	40-gallon cart: $14.85/month, 9¢/gallon 68-gallon cart: 17.76/month, 7¢/gallon 95-gallon cart: 21.07/month, 6¢/gallon 68-gallon & 95-gallon carts 37.28/month, 5¢/gallon
Oakland, CA	20-gallon can: $10.08/month, 13¢/gallon 1st 32-gallon can: 13.74/month, 11¢/gallon Each extra 32-gallon can: 16.49/month, 13¢/g
Portland, OR	20-gallon can: $14.60/month, 18¢/gallon 32-gallon can: 17.60/month, 14¢/gallon 35-gallon cart: 19.30/month, 14¢/gallon 60-gallon cart: 24.05/month, 10¢/gallon 90-gallon cart: 27.10/month, 8¢/gallon
Tacoma, WA	60-gallon can: $17/month, 7¢/gallon 90-gallon can: 25.50/month, 7¢/gallon
Spokane, WA	20-gallon can: $8.56/month, 11¢/gallon 1st 30-gallon can: 11.07/month, 9¢/gallon Each extra 30-gallon can: 6.01/month, 5¢/gallon
Colorado Springs, CO	1 34-gallon can + 1 30-gallon bag: $9.50/month, 4¢/g 2 cans and 2 bags: 11/month, 2¢/gallon 3 cans and 3 bags: 13/month, 2¢/gallon
Downers Grove, IL	30-gallon bag: $1.50, 5¢/gallon
Hoffman Estates, IL	30-gallon bag: $1.45, 5¢/gallon
Woodstock, IL	30-gallon bag: $1.56, 5¢/gallon
Grand Rapids, MI	30-gallon bag: $0.85, 3¢/gallon 30-gallon can: 44.20/year, 3¢/gallon
Grand Rapids, MI	64-gallon cart: $15/month, 6¢/gallon 104-gallon cart: 17/month, 4¢/gallon
Grand Rapids, MI	90-gallon cart: $17.35/month, 5¢/gallon
Lansing, MI	30-gallon bag: $1.50, 5¢/gallon
Lansing, MI	63-gallon cart: $12/month, 5¢/gallon 104-gallon cart: 15/month, 4¢/gallon
Lansing, MI	60-gallon cart: $11/month, 5¢/gallon 90-gallon cart + 3 30g bags: 13.40/month, 2¢/g

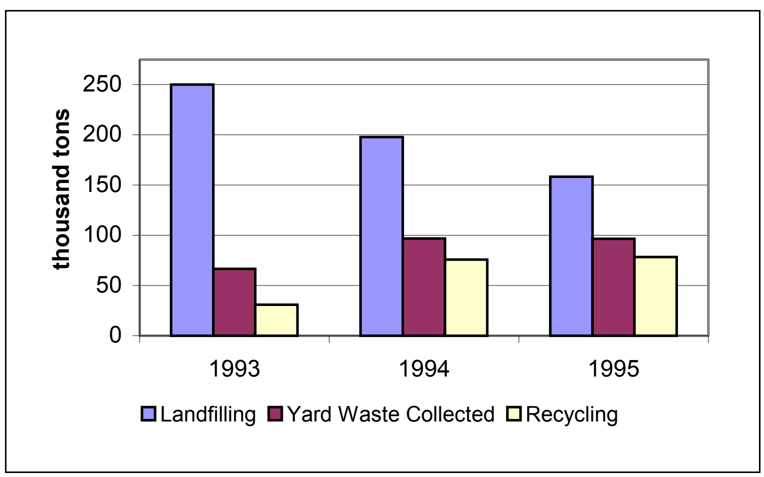
Sources: Miranda and Aldy. 1996; Bauer and Miranda. 1996.

haulers (e.g., Oakland). In both open and franchise systems, communities can set rules regarding collection fees. In St. Paul, Minnesota, for example, the city operates no collection program but requires that collectors charge variable rates, and Portland's open system has no city program but sets the collection fees that private haulers charge their customers.

Many communities with variable rates implement public education, curbside recycling, yard waste, white goods (e.g., refrigerators), and holiday greenery collection programs as well. Education has been found to be an important element in the success of variable rate programs. The collection frequency, fees, materials collected, and participation requirements for these programs, with the exception of public education, vary across communities. These complementary activities can have an important impact on the success of variable rate programs.

San Jose, California, began its variable rate program in 1993. The city contracts its waste collection and curbside recycling services to two different firms. One company serves the approximately 80,000 single-family households in the northern half of the city as well as all multi-family housing. The other business serves about 105,000 single-family households in the southern half of the city. A combination cart/sticker system is used to price household waste collection. Residents subscribe to specific cart sizes and pay the fees shown in Table 4-6 for weekly collection of the waste in these carts. When these households have too much garbage for their cart sizes, they can put the excess garbage in 32-gallon plastic bags, provided the bags each bear a sticker sold for $3.50 at local libraries, supermarkets, and convenience stores. Multi-family dwellings pay flat fees. One potential advantage of the stickers is that they give households the flexibility to exceed planned waste generation on occasion. San Jose also offers free curbside collection of recyclables and yard waste and collects white goods for a separate fee of $18 for up to three items. Figure 4-2 suggests that the variable rate program has significantly reduced the amount of waste sent to landfills and increased the amount of recycled waste. The amount of yard waste set aside for collection and subsequent composting also increased.

Figure 4-2. Solid Waste Flows in San Jose



Source: Miranda and Aldy. 1996

The variable rate systems described thus far base prices on waste volumes. Another, less common price basis is weight. Communities that have implemented weight-based pricing include Seattle, Milwaukee, Minneapolis, Durham (NC), Columbia (SC), and Farmington (MN). Such systems could have a stronger incentive effect by charging for every additional unit of weight and thereby eliminating the incentive given by volume-based systems to compact trash into containers. Seattle's weight-based scheme lowered the weight of garbage collected by 15%. One disadvantage of weight-based systems is that they tend to be technologically much more complicated, requiring that collection trucks carry specialized equipment and increasing the time haulers take to collect waste.

Seattle, for example, found that collection times were extended by 10% under the city's weight-based system. If the weight of garbage decreases enough, however, there is the potential to offset the increased implementation costs.[43]

In most areas where variable rate programs have been introduced, the amounts of waste collected have decreased significantly, a result of either increased recycling or decreased waste generation.

- A 1998 study of 114 variable rate cities and 845 traditional fixed rate communities estimated a 43.8% reduction in waste disposal after those cities and communities began to charge $1 for every 32-gallon bag.[44]
- A 1992 survey of 14 cities with variable rate programs found that the amount of waste destined for disposal decreased by an average of 44% during the first year following program initiation.[45]
- A study in Maine found that municipalities with variable rate systems disposed of less than half as much waste per capita as municipalities without such systems.[46]
- Surveys in Tompkins County, New York, and Dover, New Hampshire, found that variable rates led consumers to think of ways to reduce waste generation, including altering their purchasing habits.
- A 1996 study of four communities in California and five in the Midwest found that they achieved reductions in waste disposal of 6% to 50% after introducing variable rate systems. The higher the unit prices, the greater the reductions. Moreover, reductions were greater in those communities with relatively small minimum container sizes. If the minimum container size is too large, consumers often have little incentive to alter their behavior.[47]
- As shown in Table 4-7, another study found reductions in the tons of waste sent to landfill, reductions that ranged from 17% to 74% following the adoption of variable rates in 21 northern cities. The study reached two conclusions. First, the magnitude of the unit prices was positively correlated with the change in the amount of waste recycled. (That is, the higher the price per unit of waste, the more waste was recycled). Second, unit prices were negatively (not the right term) correlated with the change in the amount of waste landfilled. That is the higher the price per unit of waste, the less waste that was sent to landfills and the more waste that was recycled.

  The recycling increases shown in Table 4-7 were achieved in geographic areas that did not simultaneously implement recycling programs. In places where the adoption of variable rate programs has coincided with new public recycling activities, however, it is difficult to determine how much of the decline in waste disposal is due to the variable rates and how much is due to the new recycling alternatives. The Dover survey found that curbside recycling programs alone encouraged recycling but that variable rates provided additional incentive.[48] Another study estimates that a variable rate program will increase the amount of waste that is recovered under existing recycling programs by 4% to 13%.[49]
- Nestor and Podolsky (1998) reported on the results of an experiment in the city of Marietta, Georgia. In January 1994, the City of Marietta simultaneously introduced a bag/sticker program and a subscription can program in different parts of the city. After adjusting for seasonal effects, Nestor and Podolsky estimate that households participating

in the bag program reduced their garbage disposal by approximately 23% while households participating in the subscription can program decreased waste disposal by only about 8%. The explanation for this difference is that the bag/sticker program offers households more flexibility on a week-to-week basis regarding the amount of waste they are required to pay for. Households who are able to set out smaller-than-usual amounts of waste immediately benefit from it. The bag/sticker program gives households greater incentive to reduce waste because they are not committed to a specified number of containers each week.

Table 4-7. Responses to Variable Rate Pricing

Municipality	% Reduction in Tons of Waste Landfilled	% Increase in Tons of Waste Recycled
Antigo, WI	50	145
Charlemont, MA	37	N/A
Downers Grove, IL	52	N/A
Grundy Center, IA	32	N/A
Hancock, VT	33	N/A
Hartford, VT	17	29
Harvard, IL	33	113
High Bridge, NJ	18	N/A
Huntingburg, IN	74	N/A
Illion, NY	51	141
Ithaca, NY	31	63
Lisle, IL	53	N/A
Mt. Pleasant, IA	49	N/A
Mt. Pleasant, MI	44	141
Perkasie, PA	54	157
Plains, PA	49	88
Quincy, IL	41	45
River Forest, IL	19	N/A
St. Charles, IL	41	456
Weathersfield, VT	36	150
Woodstock, IL	31	N/A

Source: Miranda, as reprinted in Arner and Davis.

Despite the evidence cited in Figure 4-7, variable rate programs have some unresolved problems. Data on decreases in collection can be misleading if the programs result in significant illegal disposal of waste or the diversion of waste to cheaper disposal services. Illegal dumping includes direct discharge to the environment as well as placing waste in someone else's container or donating irreparable items to charitable organizations. Direct discharge to the environment is likely to be of more concern than other types of illegal disposal. The Maine study found that an increase in backyard burning and a slight increase in roadside dumping and illegal disposal in commercial containers coincided with variable rate systems. Of the 14 cities surveyed in Skumatz (1993), "six cities reported no problem with dumping, four reported minor problems, and four reported notable problems." Among the measures cited to limit illegal disposal are creation of viable recycling alternatives, public education, locking commercial dumpsters, high dumping fines, and flat collection fees that entitle households to a minimum level of service.[50]

Other problems need to be addressed in designing and managing variable rate programs. They can be difficult to implement in multi-family housing such as apartments, and they can have a regressive effect on large families. Variable rates are likely to be regressive because the amount of waste produced per thousand dollars of income is likely to be higher for a poor household than for a more affluent household. In addition, variable rate programs can lead to significant decreases in revenue for municipal waste collectors because households reduce the amount of solid waste that they generate.

Variable rate programs may not be appropriate for all communities. Analysts assert that variable rate pricing is unlikely to be successful in communities having the following characteristics: (1) those with affordable and environmentally acceptable landfills; (2) those with few or no nearby recycling facilities; (3) those with open spaces located nearby, which makes that land vulnerable to illegal dumping; and (4) those with consumers who oppose paying variable rates.[51] In some areas, however, variable rate programs appear to be beneficial. According to a World Resources Institute (WRI) study, "Where landfill costs are high, disposal charges would generate net economic savings of $0.17 for every dollar of revenue collected, even after the gross costs of curbside recycling programs were paid."[52]

4.4.2 Landfill Taxes

According to the National Recycling Coalition, surcharges on waste delivered to landfills have been imposed in over 20 states.[53] If operators are capable of passing on such taxes to their customers in their disposal fees, landfill taxes could have effects similar to variable rate programs.

New Jersey levies three different landfill taxes: a Solid Waste Services Tax of $1.05 per ton, a Landfill Closure and Contingency Tax of $0.50 per ton, and a Solid Waste Recycling Tax of $1.50 per ton. For waste in liquid form, rates for the Solid Waste Services Tax and the Landfill Closure and Contingency Tax are 0.002 cents per gallon, and rates for the Solid Waste Recycling Tax are 0.00225 cents per gallon.

In Pennsylvania, counties are required to create trust funds to finance the costs associated with closing landfills and to finance these trust funds with disposal fees. The per ton disposal fee is calculated by dividing the estimated cost of closing the landfill by the estimated weight of the garbage that will be sent to the landfill before it is closed.

Texas levies a fee of $1.50 per ton on the disposal of all municipal solid waste. In part, fee revenues are used to fund the state's efforts to control solid waste. They are also used to provide grants to local governments and other organizations for recovering resources, minimizing the amount of waste, and developing programs that help enhance the efficiency of solid waste management facilities.[54]

It is unclear whether these landfill taxes have produced a significant incentive effect. Moreover, as is the case with variable rate programs, increasing the price of waste disposal creates incentives to use alternative disposal options. The District of Columbia's experiences with its nearby Lorton, Virginia, landfill is a case in point. Of the $64.39 per ton tipping fee at Lorton, $28.39 per ton was reserved for the District's residential recycling program. Private trash haulers have reportedly trucked waste to landfills located elsewhere in Virginia and southern Pennsylvania, where tipping fees are lower. The resulting loss in revenue from tipping fees led the District to suspend its recycling program in 1995. It subsequently reestablished the program but with reduced service. Because of the instability of these tipping fee revenues, the District now relies on general revenues to fund its recycling program.

4.4.3 Hazardous Waste Taxes

A 1998 survey identified 30 states that impose taxes on the generation or management of hazardous wastes.[55] Some of these states have higher tax rates for landfilling than for incineration, and several states impose no tax on incineration. In some states, taxes vary according to the type of waste or whether the waste was generated outside the state, or both of these factors. In addition, on-site disposal of hazardous waste is exempt from taxes in some states. Vermont and California each levied taxes of more than $100 per ton for land disposal of hazardous waste, and six other states levied taxes of more than $50 per ton. The mean tax level for all states, including those with no tax, was $21 per ton. To put these taxes into perspective, in the late 1980s a middle-of-the-range estimate of the costs associated with the disposal of hazardous waste was $132 per ton.

California levies fees on both the generation and disposal of hazardous waste. As shown in Table 4-8, California imposes taxes on hazardous waste disposal that range up to $220 per ton. Generation fees vary by quantity generated, with rates fixed within a given range of tons per year. (See Table 4-9.)

Table 4-8. Hazardous Waste Landfill Fees in California

Waste Category	Rate ($/ton)
Non-RCRA cleanup wastes	$7.50
Other non-RCRA wastes	17.94
Ores and minerals	14.30
Extremely hazardous waste	220.00
Restricted hazardous waste	220.00
Hazardous waste (RCRA)	44.44

Source: California Department of Toxic Substances Control.

Table 4-9. California Hazardous Waste Generation Fees

Weight of Waste Generated (tons/year)	Fee ($)	Middle Range of Rates Charged ($/ton)
Less than 5	$0	$0
5 to 25	169	11.3
25 to 50	1,348	35.9
50 to 250	3,371	22.5
250 to 500	16,855	44.9
500 to 1,000	33,710	44.9
1,000 to 2,000	50,565	33.7
More than 2,000	67,240	<33.7

Source: California Department of Toxic Substances Control.

According to the California Department of Toxic Substances Control, the two fees are intended to raise revenue and to encourage waste minimization. The tonnage of hazardous waste sent to landfills has declined in the last 10 years. It is difficult, however, to determine to what extent this decline is due to the fees, as many other factors could influence generation and disposal practices.

Hazardous waste is also subject to numerous other administrative fees in California. Efforts are currently being made to simplify the existing fee structure, which is widely viewed as too complicated.[56]

The findings of several studies suggest that taxes on hazardous waste have had an impact on disposal. Two engineering studies, one by the Congressional Budget Office (1985) and the other by EPA (1984), concluded that such taxes significantly reduced the disposal of hazardous waste in landfills. By 1987, 10 states had taxes exceeding the level at which EPA predicted a 60% reduction in landfill disposal. Another study examined empirical evidence on the effects of a twofold rise in hazardous waste taxes in New York in 1985. It found that the quantity of hazardous waste disposed of in the state decreased significantly. Because taxes on incineration remained constant in this case, the amount of waste incinerated rose, but it did not increase as much as the amount of waste sent to landfills declined.[57]

Sigman (1996) studied the impact of landfill and incineration taxes on the generation of four types of chlorinated solvent wastes from metal cleaning. Using data from the 1987–1990 Toxics Release Inventories, the study included a cross-section analysis of generation across states and used a number of independent variables, including disposal taxes in the state of generation and in neighboring states. It also studied the impact of disposal taxes and other factors on the choice of disposal method. The study reached two conclusions. First, elasticities of waste generation with respect to these taxes on disposal were in the range of -7 to -22, meaning that the quantity of hazardous waste sent to landfills or incinerators was very sensitive to the tax. Second, the taxes encouraged generators to choose incineration or other treatment options as their waste management method, instead of landfilling. However, the estimated impact of these taxes was minor because the fees were low in comparison to the total costs of waste management.

Although "[s]tates' experience suggests that taxes may provide an alternative to the standard-based policies now used for most hazardous waste regulation," Sigman found, the design and implementation of such taxes pose several potential problems, including the determination of tax levels. To maximize the efficiency of these taxes, they should reflect the social cost of hazardous waste generation. This cost, however, depends on the type of waste, the method of disposal, the geographic location, and various other factors that are difficult to assess and incorporate into tax structures. If, on the other hand, taxes are too high, they could encourage illegal dumping, of which even a small amount could cause enough environmental damage to offset the increased efficiency achieved by taxes. "In the presence of illegal dumping," the study states, "a deposit/refund program may be substantially less costly than a waste-end tax."

Because current federal regulations impose high costs on generators of hazardous waste, there may already exist sufficient incentives to reduce the generation of hazardous waste. If existing regulatory incentives are sufficient, taxes could raise the costs of waste disposal to a level that is higher than what is socially desirable.

4.5 Product Charges

Product charges are imposed on either a product or some characteristic of that product. Economic theory suggests that products whose disposal causes environmental pollution should be taxed to reflect the added social costs they impose. To date, the theoretically ideal product charge has not been imposed. Although some product charges may be large enough to have a significant effect on behavior, most of them are intended primarily to raise revenue. Product charges typically take the form of advance disposal fees (ADFs) or of taxes on a product designed to fund its proper disposal after use.

A traditional regulatory mechanism that competes with the product charge is termed "extended producer responsibility;" it relies on take-back requirements placed on the manufacturers of certain products. Producers bear the responsibility for ensuring the proper disposal of post-consumer waste. Although some states have implemented extended producer responsibility for selected products, the federal government has never endorsed such an approach.[58] Several European nations have also enacted rules regarding extended producer responsibility.

4.5.1 Federal Product Charges

A number of federal product charges have been imposed, including charges on fuels, transportation, transport equipment, and chemicals. Most of these taxes are intended to raise revenue. Consequently, they have minimal effect on incentives. For a list of federal environmental excise taxes, see Barthold (1994). The following subsections in this chapter discuss the Superfund taxes, taxes on fuel-inefficient automobiles, and taxes on chlorofluorocarbons (CFCs).

4.5.1.1 Superfund Taxes

Until the end of 1995, the federal government imposed taxes on oil, chemicals, and business profits to fund the cleanup of inactive hazardous wastes designated under Superfund. This activity was financed by taxes on crude oil (9.7 cents per barrel), chemicals ($0.22-$4.87 per ton), and gross business profits (0.12% of amounts over $2 million).[59] Congress did not extend the tax after its scheduled expiration. The oil and chemical taxes could be regarded as product charges or raw material input taxes. Their primary purpose, however, was to raise revenue, rather than to prevent pollution.

4.5.1.2 Taxes on Gas Guzzlers

Introduced in 1978, the gas-guzzler tax is imposed on the sale of new automobiles with a fuel efficiency of less than 22.5 miles per gallon. Sports utility vehicles (SUVs), minivans, and trucks are not subject to the tax. The magnitude of the tax ranges from $1,000 to $7,700 per automobile, depending on fuel efficiency. Revenues, which amounted to $144.2 million in 1992, contribute to the Highway Trust Fund.[60] Most gas-guzzler tax payments have been made by buyers of foreign luxury cars.

Two measures that could have effects similar to gas-guzzler taxes are fines for the failure to meet corporate average fuel efficiency (CAFE) standards and taxes on luxury cars. CAFE fines, which could be regarded as non-compliance fees, are based on the extent to which an auto manufacturer violates CAFE standards. These fees could provide an incentive for manufacturers to invest in the design of fuel-efficient cars. Luxury taxes are set at 10% of the sales price of a car in excess of a base level, which was originally set at $30,000 but has since increased. Since many luxury cars are relatively fuel-inefficient, luxury car taxes could encourage the use of more fuel-efficient vehicles.

4.5.1.3 Ozone-Depleting Chemicals

In accordance with the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer and subsequent amendments, the production of ozone-depleting chemicals (ODCs) such as chlorofluorocarbons (CFCs) for most uses in the United States was phased out by January 1, 1996. To facilitate the phaseout, the United States imposed a tax on selected ODCs on January 1, 1990; the government expanded that tax to other ODCs the following year. The magnitude of the tax was determined by multiplying a base rate per pound of ozone-depleting chemicals produced or imported by an ozone depletion factor that varied according to the type of chemical. Initially set at $1.37 per pound, the base tax amount increased to $3.35 in 1993, $4.35 per pound in 1994, and $5.35 in 1995. Since 1996, the annual increase in the base tax amount has been $0.45 per pound per year. The ozone depletion factors, which are intended to indicate each chemical's damage to the ozone layer, were set by the Montreal Protocol.[61] For example, methyl chloroform had a factor of 0.1, whereas Halon-1301 had a factor of 10.0, which meant that methyl chloroform was taxed at $0.53 per pound in 1995 while Halon-1301 was taxed at $53.50 per pound that year. The tax was imposed on producers and importers of these chemicals as well as on the importers of products that contained these chemicals or that used them in their production processes.

Unlike most product charges, this tax is widely credited with a significant incentive impact. ODC consumption (expressed in CFC-11 equivalents using the above-mentioned ozone depletion factors) fell from 318,000 metric tons in 1989 to 200,000 metric tons in 1990, the year the tax was introduced.[62] A Congressional Research Service (CRS) study concluded, "the CFC tax has clearly accelerated the rate at which CFC uses are being substituted for and the rate at which CFCs are being recovered for reuse." CRS adds that the tax was also intended to raise revenue for the federal government and to capture a portion of the windfall revenues experienced by ODC producers as a result of the tightened supply of ODCs.[63]

According to the World Resources Institute (WRI), the tax raised $2.9 billion in its first five years. WRI adds that the phaseout cost less than EPA's original projection.[64] In 1988, EPA predicted that the average cost of reducing the use of CFCs by 50% would be $3.50 per kg. In 1992, EPA revised its cost estimate to only $2.45 per kilogram.

The tax is believed to have contributed significantly to the reduction in ODC use. Several other factors, however, also had an impact, including the establishment of an ODC trading system (described in Chapter 6); the well-publicized intentions of the federal government to phaseout ODC use; and EPA's work with the private sector on ODC recycling and the use of substitutes. As a result of the multiplicity of these policy measures, it is difficult to isolate the effects of the CFC tax.

4.5.2 State Product Charges

States have imposed charges on a number of products, including beverage containers, fertilizers, furniture, motor oil, pesticides, refrigerators, solvents, and tires. Some of these have taken the form of advance disposal fees (ADFs). Hoerner (1998) identified approximately 400 environmental taxes that are imposed at the state level. Some taxes, such as those on the sale of tires, are found in well over one-half of the states. Litter taxes, which are imposed on the sale of products that commonly are found in litter, are found in a handful of states. Many states impose severance taxes on the removal of minerals from the ground. This section highlights a few of the charges that states impose on different products.

4.5.2.1 Tire Charges

Fees are imposed on automobile tires in at least 34 states. The fees generally range from $0.25 to $2.00, but Texas has a fee of $3.50 on truck tires. Some of the fees are assessed as a percentage of the price of the tires. Given the low magnitude of the charge levels relative to the price of tires and the lack of substitutes for tires, the incentive effect of state tire charges on the buyers of tires is likely to be minimal; however, the system does encourage the proper disposal of tires. Most fees were instituted as part of a scrap tire program, which included restrictions or bans on the disposal of used tires in landfills.[65] States use their tire fee revenues to subsidize the development of markets for end uses of used tires, such as rubberized surfaces, noise barriers, blasting mats, and rubberized asphalt pavement. Fee revenue also may be used to pay for the cleanup of tire disposal sites and for the enforcement of laws designed to prevent illegal disposal. The effect is that tire buyers pay for the proper disposal of used tires through these tax/subsidy schemes.

As shown in Table 4-10, the federal government also imposes product charges on tires, charges that range from $0.15 to $0.50 per pound. Revenues from these charges are allocated to the Highway Trust Fund.[66]

Table 4-10. Federal and State Tire Charges

Taxing Authority	Fee Structure	Uses of Revenues
Federal Government	Tires 40–70 lbs: $0.15/lb x weight exceeding 40 lbs Tires 70–90 lbs: $4.50 + $0.30 x weight exceeding 70 lbs >90 lbs: $10.50 + $0.50 x weight exceeding 90 lbs	Highway Trust Fund
State Governments (34)	$0.25 to $2.00 for passenger car tires	Tire recycling, tire disposal site cleanup, other similar activities

Source: Fullerton. 1995, p. A7; *Scrap Tire News Legislative Report,* pp. 18–19.

4.5.2.2 Fertilizer Charges

At least 46 states impose charges on the sale of fertilizers. Nebraska's fee of $4 per ton is one of the highest; most are below $1 per ton. Assuming fertilizer prices of $150–$200 per ton, the charges are too low to significantly influence the use of fertilizer. The most common use of these charge revenues is the inspection of fertilizers and fertilizer storage by state agencies.

4.5.2.3 Rhode Island Hard-to-Dispose Material Tax

Rhode Island imposes charges on "hard-to-dispose material," such as lubricating oil, antifreeze, organic solvents, and tires. The fees are 5 cents per quart of lubricating oil, 10 cents per gallon of antifreeze, 0.25 cents per gallon of organic solvents, and 50 cents per tire. Although the incentive effects are assumed to be minimal, the charge incorporates at least some of the disposal costs of these various materials into their prices. Charge revenues are deposited in a "hard-to-dispose material account" that funds educational and technical assistance programs, grants, research, and collection centers for hard-to-dispose material.

4.5.2.4 Florida Advance Disposal Fee (ADF)

In a two-year experiment with ADFs, on October 1, 1993, Florida instituted a fee of one cent on a variety of containers. Exempted from the tax were containers made of plastic, plastic-coated paper, and glass that had average recycling rates of at least 50%; glass containers having 35% recycled content; and plastic containers having 25% recycled content. Paper and plastic packaging were also subject to the ADF, with exemption possibilities similar to those for glass and plastic containers. Since the Florida Department of Environmental Protection determined that aluminum and steel cans had already fulfilled the 50% recycled content requirement, they were exempt from the tax.[67] To further encourage recycling, the tax was doubled the second year it was in effect.

Despite the low-fee level, manufacturers reportedly went to considerable trouble to obtain exemptions. Their efforts appear to have been due more to the public relations value of being exempted than to the ADF itself.[68]

One interesting aspect of this ADF is the wide range of options that it gave manufacturers to obtain exemptions. These options included working with other firms in the same sector to raise recycling rates, increasing the recycled content of packaging, averaging the amount of recycled content over various containers, and recycling equivalent amounts of previously discarded waste into other products. In theory, the variety of options should have allowed each firm to select a relatively cost-effective way to promote recycling. Most firms sought exemption based on use of recycled content. However, at least two companies, Piper Plastics and Anheuser-Busch, have built, or plan to build, recycling facilities. Both companies cited the ADF as the decisive factor in their decisions to build these facilities in Florida.[69]

One disadvantage of including various exemption possibilities in the ADF was the potential administrative burden of assessing requests for exemptions. At least one industry group criticized the ADF as deceptive, burdensome, and administratively costly.[70] The ADF expired in October 1995.

4.5.2.5 North Carolina ADF

North Carolina imposes a fee on “white goods,” such as refrigerators and freezers. Beginning in 1995, the ADF was $10 for products containing CFCs and $5 for those without CFCs. Effective July 1998, the tax was reduced to a flat $3 per item and extended to July 2001.[71]

Although the ADF probably does not have a significant incentive effect, it generates revenues to manage the disposal of white goods. With the introduction of the ADF, county landfills were required to accept old white goods for disposal, free of charge. Counties received 75% of the ADF revenue on a per capita basis to fund the removal of CFCs and programs that recycle white goods and metal products. Additional ADF revenues were available for those counties whose disposal costs exceeded their per capita allocations of ADF funds from the state. In July 2001, local governments will be authorized to impose disposal fees for white goods.

4.5.2.6 Texas Clean Fuel Incentive Surcharge

In 1989, Texas introduced a 20-cent-per MMBtu-surcharge on boiler fuel oil. The surcharge applies only to industrial and utility boilers that are capable of using natural gas, that are in use between April 15 and October 15 of each year, and that are located in ozone non-attainment areas having populations of 350,000 or more. As part of a larger state effort to encourage the use of natural gas, the surcharge specifically addresses ozone problems that occur in the summer months and that caused by NOx emissions. Used oil and fuels derived from hazardous waste are exempt from this fee. Surcharge receipts are deposited in the State General Revenue Fund.[72] According to one official on the Texas Natural Resource Conservation Commission (TNRCC), the surcharge has had little if any incentive effect because few facilities used fuel oil before the surcharge was introduced.

4.6 Road User Fees

Tolls are the most common type of road user fee for financing road construction in the United States. Because these fees are purely revenue-raising mechanisms that are unrelated to environmental protection, they are not discussed in this report. However, another type of road user fee, congesting pricing—the tolls that vary by time of day or how heavily the road is being used—is intended to reflect some of the social costs of traffic congestion. One of these costs is increased emissions per mile traveled. One study estimated that if the current level of vehicular traffic in southern California flowed smoothly, emissions from motor vehicles would decrease by approximately 13%.[73] For this reason, congestion pricing is of considerable interest as an environmental management tool. Moreover, economic analysis indicates that the economic gains from congestion pricing can be large, much greater than any other traffic management tool.[74] Congestion pricing makes users aware of the impact their use of a highway has in terms of increasing the travel time of others. By making users pay the full social cost of travel and not just their private cost, highway use declines and traffic flows more smoothly.

In December 1995 in southern California, a congestion-based 4-lane toll road opened in the median of the existing eight-lane Riverside Freeway (SR-91). The road was built by private funds from the California Private Transportation Company (CPTC), and the same firm operates the toll system. CPTC is free to determine toll levels, but it is subject to a cap on the rate of return on its investment. Five different toll levels range from $0.25 to $2.50 per 10-mile trip, depending on the time of day. Toll prices are announced in advance, so motorists can plan their trips accordingly. Windshield-mounted transponders allow motorists to pay for toll-lane use without stopping at toll booths. High-occupancy vehicles (HOV) having three occupants, public transit vehicles, zero-emission vehicles, and vehicles with a disabled-person license plate are exempt from paying the tolls.

By March 1996, over 30,000 transponders were in use, a level the project had not expected to reach until late June. In interviews with the *Los Angeles Times,* express lane users have reported time savings of more than 30 minutes. CPTC adds that the toll lanes have not only reduced travel times for their users but also diminished congestion on the adjacent freeway.[75]

As part of its Value Pricing Pilot Program, the Federal Highway Administration is studying the experiences of SR-91 and is funding several other projects. Some of the pilot projects are highlighted below.[76]

- In March 1998, San Diego began a pilot project that charged for the use of lanes in the I-15 freeway based on the time of day and the level of congestion. In the first four months of the project, almost 4,000 transponders had been distributed.
- Houston began a pilot project in January 1998 that allowed a limited number of users of HOV-2 carpools into HOV-3 carpool lanes for a fee of $2 during peak travel periods.
- Beginning in August 1998, variable pricing is being used to manage traffic flows on two bridges in Ft. Myers, Florida. The program offers drivers a 50% reduction in the usual toll if they travel on either side of peak travel periods.

4.7 Wetland Compensation Fees

Wetland compensation fee systems are programs in which a regulatory agency collects fees in lieu of requiring a developer to compensate for wetland losses through their on-site mitigation or through their acquiring of credits generated by a mitigation bank. (This system is discussed in greater detail in Chapter 6.) The fees are used for mitigation projects undertaken by an agency or non-profit organization. Wetland compensation fees offer the flexibility to mitigate wetland loss in a cost-effective manner. Instead of doing mitigation at the project site, a developer pays a fee to another organization to perform mitigation activities in more suitable locations.

Fee-based mitigation mechanisms have been used in Arkansas, Florida, Illinois, Louisiana, Maryland, Mississippi, Texas, and Virginia. The magnitude of the fees is usually set to cover costs such as mitigation, land acquisition, project planning, and site management.

Initiated in 1986, Florida's Mitigation Park Program is the oldest fee-based wetland mitigation system in the United States. Fees paid by wetlands developers in lieu of on-site mitigation are deposited in the Florida Game and Fresh Water Fish Commission's Fish and Wildlife Habitat Trust Fund. These charges finance the purchase and subsequent management of large, biologically defensible Mitigation Parks. These parks, which range in size from 400 to 1,500 acres, are publicly owned but may be managed by either government entities or non-profit organizations.

To participate in the program, developers need approval from the regulatory agency with which they are working. Fees depend on the amount of wetlands developed, the type of habitat impacted, and the species present at the site of the development. The developer pays one fee to finance land acquisition; a second fee (15% of the first fee) to fund site management; and a third fee (7% of the sum of the first two charges) to their state's tax department. Interest accrued on the second fee is used to fund site management. As of 1999, the Mitigation Park Program had received more than $17 million in deposits and had purchased in excess of 7,000 acres.[77]

In Maryland, the mitigation fees paid by developers into the Nontidal Wetlands Compensation Fund depend on the number of acres and type of wetlands impacted and the costs of wetland restoration and construction. The mitigation ratio (the number of acres that must be enhanced, restored, or created for every acre impacted) is 1:1, 2:1, or 3:1, depending on the type of wetland impacted. The 3:1 ratio applies to wetlands of special concern to the state. Land acquisition costs are assessed on the basis of the prevailing market prices for agriculturally zoned or low-density land that has little potential for development. Restoration and construction costs are assessed at $10,000 per acre in low-cost counties and $50,000 per acre in high-cost counties. Counties with a relatively large amount of farmed hydric soils, which indicates the former presence of wetlands, are placed in the low-cost category. Losses of less than 5,000 square feet of wetlands do not require mitigation.

In Louisiana, companies are required to offset their damage to coastal wetlands by performing a mitigation project on their own property or by contributing mitigation fees to the Louisiana Wetlands Conservation and Restoration Fund. Mitigation fees range from $1,500 to $12,000 per acre, depending on the environmental quality of the wetland that is lost to development.

The costs, benefits, and incentive effects of wetlands compensation fees have not been comprehensively studied, and it would be difficult to determine those effects given the varied functions that wetlands perform. Some evidence suggests, however, that such fees have been beneficial. Clustering individual mitigation activities into selected areas increases the viability of the wetlands. Moreover, the fact that developers have participated in fee-based schemes suggests that paying fees is more economical for them than conducting on-site mitigation activities on their own.

4.8 Grazing Fees

Federal and state governments charge fees for animal grazing on public lands. Federal fees date back to 1906 and are currently charged for grazing on about 167 million acres of Bureau of Land Management (BLM) land and 94 million acres of Forest Service land. About 10% of the livestock producers in the 16 Western states participate in the program. Grazing on BLM land accounts for approximately 2% of total beef-cattle feed in the 48 contiguous states. Fees are charged based on a formula that was established by the 1978 Public Rangelands Improvement Act (PRIA).[78] The PRIA formula is based on private grazing rates, beef cattle prices, and the cost of livestock production. The fee is expressed in animal unit months (AUM), where one AUM is the amount of forage required to sustain one cow and her calf, one horse, or five sheep or goats for a month. The fee in 2000 is a minimum of $1.35 per AUM, the same minimum fee imposed by President Reagan in 1986.[79]

The theory behind such fees is that animal owners should pay fair market value for the use of the land and that they should bear the costs of the damage inflicted by their animals on that land. However, current fee levels are widely believed to be lower than what would be charged if the grazing rights were being sold by a private owner. That belief is supported by the fact that properties with attached federal grazing rates command higher market prices than properties without such grazing rights. Moreover, the fees may not adequately compensate the federal government for the environmental destruction caused by the movement of privately owned animals on public lands. To the extent that the fees are too low, they amount to a form of subsidization. Therefore, they are included in the discussion of environmentally harmful subsidies in Chapter 7.

4.9 Minnesota Contamination Tax

The Minnesota Contaminated Property Tax, which entered into effect in fiscal year 1995, is levied on the "contamination value" of property, i.e., the difference in the value of the property before and after contamination. Owners of contaminated property who do not have approved cleanup plans pay this fee at the full property tax rate. The contamination tax is halved for owners who have filed an approved cleanup plan. Owners who purchase contaminated land without being notified by the seller of the contamination pay 25% of the full property tax rate until they file a cleanup plan, after which the tax rate decreases to 12.5%. According to a local tax official, the tax gives property owners "a strong impetus to clean up."[80]

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