MARKET FORCES CAN HELP LOWER WASTE VOLUMES

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The massive quantities of industrial and household waste American society generates cause a diverse set of problems, including shortages of landfill space and human exposure to toxic substances. Waste management, then, is not a single policy problem but a label for a broad range of environmental challenges. Such diverse problems call for an equally diverse set of policy mechanisms.

Although most municipal waste is not toxic, hazardous household materials—batteries, inks, used oils, antifreeze, paints and paint solvents, insecticides, and herbicides—often find their way into the municipal solid-waste stream.

In recent years, the United States has landfilled 73 percent of its municipal solid waste, incinerated 14 percent, and recycled 13 percent.[1]

Traditionally, state and particularly local governments have held primary responsibility for regulating or managing the collection and disposal of municipal and industrial solid waste. The federal government began to play a minor role in the mid-1960s. In 1976, the Resource Conservation and Recovery Act (RCRA) increased the federal role in solid-waste regulation, most importantly by requiring the Environmental Protection Agency (EPA) to issue regulations regarding landfill design, construction, and operating standards.

The pace of response by all levels of government has accelerated. In 1990, more than 75 bills dealing with solid-waste management were introduced in Congress, and EPA announced a national goal of reducing the solid-waste stream 25 percent by 1992 and 50 percent by 1997 through recycling and source reduction.[2]

Many states have issued directives calling for even larger reductions. Moreover, states and localities have adopted various strategies to limit waste and increase recycling, including mandatory separation by households, prohibitions on the disposal of specific items in landfills, and bans on packaging

and products. In addition, nine states have enacted deposit/refund systems for beverage containers.

Sources of toxic substances are numerous and diverse. Every day, every person uses a variety of products and services that generate hazardous wastes either in their manufacture or use. Estimates of total annual hazardous-waste generation range from 250 to 500 million tons. This means that, on average, each person in the United States "generates" upwards of one ton of hazardous waste per year.[3]

The overall problem is enormous, with aggregate national cleanup costs expected to run between $300 and $750 billion by the turn of the century.

Federal hazardous-waste management policies, which have evolved over three decades, focus on reducing emissions of various substances to specific media, such as air, land, or water. Single-purpose laws, such as the Clean Air and Clean Water acts, sometimes do little more than transfer toxics from one medium to another. For example, wastewater treatment facilities and air-pollution control devices may produce sludges considered hazardous under RCRA; likewise, surface impoundments of toxic substances regulated under RCRA may produce noxious air emissions—volatile organic compounds—that are a target of the Clean Air Act.

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Two major federal laws regulate the management of hazardous wastes. RCRA was designed to govern the transport, treatment, and disposal of currently generated wastes, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, more commonly called Superfund, was intended to clean up abandoned disposal sites thought to present significant risks.

RCRA addresses the management of hazardous waste in a variety of ways, including the creation of a "cradle-to-grave" tracking system intended to discourage "midnight [illegal] dumping" by keeping close tabs on the location of hazardous waste in the system and by creating detailed records of generation and disposal.

In contrast, Superfund focuses on abandoned hazardous-waste sites and accidental releases. The Superfund law was intended to identify and remedy hazardous-waste sites that pose the greatest danger to human health and the environment.

To this end, EPA established a National Priorities List. To help finance government activities and hasten cleanup efforts, Congress also set up the Hazardous Substance Response Fund. It allocated $1.6 billion over the program's first five years and later expanded the program under the Superfund Amendment and Reauthorization Act of 1986 (SARA) to $8.5 billion over an additional five years.

MAKING THE PRICE RIGHT

At the core of most municipal solid-waste problems are flawed price signals that fail to convey to consumers and producers the real costs of the wastes they generate.

People are not aware of the costs of waste collection and disposal because, in most communities, these costs are embedded in property or other taxes.

Some municipalities have highlighted the costs of waste disposal by labeling a separate charge for waste collection in their semi-annual property tax assessments. However, because charges usually are levied as flat fees that do not vary with the quantity of waste generated, no incentive exists for people to modify their purchasing and disposal decisions.

Fundamental to an effective waste-management strategy is the removal of these distortions by getting the prices right.

Unit Pricing. By charging households for waste collection services in proportion to the amount of refuse they leave at the curbside, unit pricing can tie household charges to the real costs of collection and disposal.[4] This strategy creates strong incentives for households to reduce the quantities of waste they generate, whether through changes in their purchasing patterns, reuse of products and containers, or composting of yard wastes.[5]

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Furthermore, by placing different unit charges on unseparated refuse and on specified, separated recyclables, cities can create incentives for households to separate the recyclable components of their trash. While encouraging reductions in the solid-waste flow, unit pricing also provides flexibility to consumers and producers in making their consumption and production decisions.

If municipalities are to rely on unit pricing for collection and disposal services, they need to consider several important design and implementation issues.

In some of the initial forays into unit pricing, several communities, including Seattle, billed households for the number and size of trash receptacles they left at the curbside. These programs substantially reduced the total flow of solid waste into landfills, but they raised concerns about equity because low-income households likely paid greater shares of their incomes for garbage pick-up than higher-income households.[6] The Seattle system addresses this issue much as electrical utilities do—with low "life-line rates" for initial blocks of usage.

Per-can pricing is a step in the right direction, but "bag-and-tag" systems—where households dispose of unseparated refuse in specially designated trash bags sold by the municipality—do an even better job of linking costs to disposal volumes.

A related approach involves the sale of stickers that are placed on cans or bags of specified dimensions. While metering and billing costs for bag-and-tag systems can be kept low, a reasonable concern with these approaches is the possibility of illegal dumping.

The experiences of Seattle and other communities suggest, however, that illegal dumping may not be a problem if systems are designed properly. New programs can be introduced incrementally, with charges rising gradually until they equal the true marginal costs of disposal. Also, municipalities can provide free or low-cost disposal at transfer stations, thus removing some of the incentive to dump illegally. Furthermore, stiff penalties for illegal disposal are important.

Finally, unit pricing has obvious limitations in multi-unit apartments where

residents can dispose of their waste anonymously, thus free-riding on the charges paid by others. This last point suggests that unit charges are not a panacea for solid-waste management problems. While they are likely to yield good results for many communities, they have less potential for others, especially densely populated urban areas.[7]

Some communities have combined unit charges for unseparated refuse with free or low-cost curbside collection of recyclable materials, giving consumers additional control over their waste charges.

Whether or not special provision is made for separated recyclables, accurate unit pricing of collection and disposal of municipal solid waste is a promising approach to an increasingly serious problem. Unit pricing can provide signals to waste generators that appropriate levels of source reduction should be included in their waste-management decisions. By providing a high degree of choice to consumers and firms, this approach combines cost-effectiveness with minimum inconvenience.

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Retail Disposal Charges. Although unit charges should be considered as the first line of attack on solid-waste management problems, it often is desirable to raise price signals at the point of purchase instead of the point of disposal. One way to accomplish this is for communities to place retail disposal charges (sales taxes) on certain items to reflect the costs of disposal and packaging.[8]

Retail disposal charges merit consideration in two principal situations. The first is where unit curbside collection charges are impractical; for example, the prevalence of large, multi-unit residences make curbside collection charges difficult to administer. Second is for products that carry high disposal costs that exceed the costs associated with their volume. Such charges might be considered for a limited number of household products that have serious environmental consequences in landfills or incinerators.

Virgin Material Charges. A third approach to improving price signals for solid-waste management is to incorporate disposal costs at the point of production. This can be done by levying charges on virgin materials to reflect their eventual disposal costs. Such charges would encourage consumers to switch to materials and products with lower disposal costs, especially recycled materials.

The principal advantage of virgin material charges is the ease of administration, particularly in comparison with retail disposal charges. But because virgin material charges would need to be computed on a standardized national basis, a disadvantage would be their insensitivity to local conditions. If charges reflected average conditions, consumers in low-disposal-cost areas would pay too much for the products, while people in high-disposal-cost areas would pay too little.

RECYCLING MARKET

Policy makers increasingly view recycling as an important element of waste management. It can reduce the amount of waste that ends up in landfills.

However, as more states and cities adopt recycling programs, the increased supply of recovered materials often outpaces demand in secondary markets. In

some instances, this glut has grown so severe that it has resulted in the landfilling of separated, recyclable materials.

To bolster demand for recycled materials, several states have passed laws requiring certain manufacturers to increase the use of recycled (secondary) materials in their products.

These state actions have led to calls for a federal role in setting national recycled-content standards. Although national standards would provide consistent requirements for manufacturers and limit their need to meet diverse state and local standards, reasonable concerns would remain regarding the costs imposed on industry and consumers.

Recycling-content regulations in isolation could lead to significant economic inefficiencies, because such uniform standards ignore the degree to which the costs of compliance vary among firms. New capital investments would be prohibitive for some manufacturers who lack the capacity to use secondary materials effectively with their existing production technologies. Conversely, other firms with different technologies may meet or even exceed minimum-content requirements at relatively low cost.

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Cost-effective allocation of recycling could be achieved through a system of tradable permits. Under such a system, the federal government would set an industry-wide recycling rate (or recycled-content standard). Businesses could meet the standard in one of two ways: they could use the required percentage of secondary materials or buy permits (credits) from firms that exceed their own recycling requirements.

The same amount of recycling would occur under a tradable permit program as under a uniform standard, but the total costs of compliance would be lower. This is because firms in the best position to recycle (or use recycled materials) would be paid by other firms to undertake the bulk of the recycling burden.

Recycling credit systems conceivably could be used for a variety of products, including newsprint, lubricating oil, and lead-acid batteries.

Let's consider the way a system would operate in the case of newsprint recycling. The program first would establish a minimum (aggregate) content standard for newsprint and possibly paperboard produced for the U.S. market. Instead of setting a uniform content requirement for all manufacturers, the program would use tradable permits to achieve industry-wide compliance while providing substantial flexibility to individual firms. Newsprint and paperboard producers and importers would be obligated to produce or import newsprint and paperboard having the required recycled content or to buy permits from other firms having a recycled content in excess of the standard.

For example, if a standard were set at 40 percent recycled fibers, a manufacturer using a smaller fraction in its production (perhaps because it was located far from sources of old newspapers) could purchase permits from a producer or importer using more than 40 percent. In this way, there also would be an economic incentive (potential revenue from recycled credit sales) for some producers to adopt technology that would provide higher recycling levels.

The full measure of potential cost savings offered by tradable permits can be realized only if efficient markets develop.[9] At least four conditions are necessary for this to occur: (1) firms must comply with the policy; (2) transac-

tion costs must be low enough so that they do not prevent efficient permit exchanges from taking place; (3) markets for permits must be competitive; and (4) there must be enough certainty regarding the permit policy for firms to be willing to engage in trade.

ILLEGAL DUMPING

Improved price signals and recycling credit programs can reduce the volume of waste reaching landfills and incinerators. Another pressing waste-management issue, however, is improper waste disposal. A market mechanism likely to reduce such problems is a deposit/refund system, whereby consumers and/or producers pay a special charge when purchasing specific products; the charge is refundable when the product is returned for recycling or proper disposal.[10]

As the costs of legal disposal increase, so do incentives for improper (illegal) disposal. As a result, fees such as unit curbside charges designed to cover the costs of disposal can increase the incidence of illegal dumping. This does not appear to be a problem in cities that have moved toward unit pricing. Moreover, it is unlikely to present a serious threat for wastes that do not pose significant health or ecological risks. For general litter, increased pick-up and stiff penalties for illegal disposal may be sufficient to mitigate the problem.

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For wastes that pose significant health or ecological impacts, however, the story may be different. For such wastes, prevention of improper disposal is important. One alternative is a front-end tax on waste precursors, because it would give manufacturers incentives to find safer substitutes and to recover and recycle taxed materials. But substitutes may not be available at reasonable costs, and, once wastes are generated, such front-end taxes will have a minimal impact of disposal practices.

This dilemma can be resolved with a special front-end charge (deposit), combined with a refund payable when quantities of the substance in question are turned in for recycling or disposal. This refund can provide an incentive to follow rules for proper disposal (and to prevent losses in the manufacturing process in which the substance is used).

The mechanics of the system would vary from product to product, but the general framework would require producers or initial users to pay a deposit when the product enters the production process. As the product changes hands during production and consumption (from manufacturer, to wholesaler, to distributor, to consumer), the purchaser would pay a deposit to the seller. Thus, once the producer sold the product, responsibility for proper disposal would pass to the next party. The process would continue until the ultimate consumer had turned in the product to a certified collection center responsible for recycling or proper disposal.

In general, properly scaled deposit/refund systems can be attractive for three reasons. First, they convert government's monitoring problem from a nearly impossible task of preventing illegal dumping of small quantities of waste at diverse sites to a more manageable task of assuring that products being returned for refund are what they are purported to be. Under a deposit/refund

system, generators have the incentive to seek the refund instead of following a midnight-dumping strategy.

Second, there is an incentive to prevent losses of the material in the industrial process in which it is used.

Third, because of inevitable net losses in the production and consumption processes, incentives will exist for firms to seek less environmentally damaging substances—that is, substances not regulated by the deposit/refund system.[11]

"Bottle bills" for beverage containers have served as the prime application of this approach. In general, bottle bills may reduce littering more effectively than they encourage recycling, because collected containers can still wind up in landfills if there are no markets for them. This last point is a reminder that deposit/refund systems are most appropriate when the objective is to reduce littering and illegal disposal; these systems are less appropriate when the goal is to reduce the solid-waste stream or increase recycling.

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Deposit/refund programs have been proposed for everything from vehicle tires to car bodies. The strongest case can be made, however, for products with very high costs of improper disposal, because the benefits of proper disposal are then more likely to exceed the costs of separation and redemption. Examples include lead-acid batteries, used lubricating oil, and certain industrial chemicals such as chlorinated solvents.

Here's how the deposit system would work for motor-vehicle batteries.[12] A deposit would be collected when manufacturers sell batteries to distributors, retailers, or original-equipment manufacturers; likewise, retailers would collect deposits from consumers at the time of battery purchase. Consumers could collect their deposits by returning their used batteries to redemption centers. These redemption centers, in turn, would redeem their deposits from battery manufacturers.

The program would be largely self-enforcing, because participants would have incentives to collect deposits on new batteries and obtain refunds on used ones. Another advantage of a deposit/refund approach is that it focuses explicitly on reducing improper disposal as the policy goal.[13]

SUMMARY

To assemble a portfolio of waste-management policies, it is first necessary to identify each problem to be addressed. For example, is the problem insufficient capacity of landfills, or littering, or other forms of illegal disposal?

In answering such questions, it becomes clear that a significant difference exists between means and ends, between policy mechanisms and goals. Increased recycling, for example, may be a valid means of achieving some legitimate waste-management goals, but recycling should not—any more than landfilling—be seen as a general objective of waste management-policy.

Legitimate objectives of waste-management policy include protecting human health and ecological values while providing sufficient waste-management services at minimal cost. In many cases, recycling—along with landfilling and incineration—will be part of a mix of strategies that will enable us to reach our waste-management goals. The question then becomes what specific policy

mechanisms belong within our overall portfolio of solid- and hazardous-waste management strategies?

For problems associated with the imbalance between the supply and demand of solid-waste management services, incentive-based policies that focus on providing better price signals are the key. In most circumstances, the first reform that should be considered is accurate unit pricing of curbside collection and disposal. This local initiative can go a long way toward fostering the cost-effective mix of landfilling, incineration, and recycling while reducing the overall solid-waste stream.

In special circumstances, there may be a role for retail disposal fees or virgin material charges. The former merit consideration as a supplement to unit curbside collection charges for specific products that result in especially high disposal costs, including household products that have serious environmental consequences. Likewise, virgin material charges may be considered for those substances not adequately addressed by unit curbside charges. An example is primary lead production.

Improved price signals are not be a panacea for all waste-management problems. Either as a partial substitute for the pricing approach or as a supplement for products with particularly high disposal costs, recycling may help achieve legitimate waste-management goals. In such cases, recycling credits—where tradable permits are combined with recycled-content standards—hold promise of raising recycling levels economically.

Although recycling-credit programs and improved price signals can reduce the volume of waste reaching landfills and incinerators, in some cases prime concern is with the improper disposal of wastes and the adverse aesthetic, health, and ecological consequences that can follow. In such cases, deposit/refund systems can provide an effective incentive-based approach. Long applied to bottles and cans, these systems may be more appropriate for containerizable waste, including lead-acid batteries, lubricating oil, and industrial solvents.

Overall, there is no silver bullet of public policy for solid and hazardous waste management. Until the ubiquitous NIMBY (Not In My Backyard) problem is addressed, even the most innovative set of waste management policies will remain, at best, a partial solution.

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NOTES

1. See Franklin Associates, Ltd., *Characterization of Municipal Solid Waste in the United States: 1990 Update* (Washington, DC: Report prepared for EPA, June 1990).
2. Coincident with the increase in legislative activity in solid-waste management has been a significant increase in the attention policy makers give to market-based approaches to environmental protection. See Robert W. Hahn and Robert N. Stavins, "Incentive-Based Environmental Regulation: A New Era from an Old Idea?" *Ecology Law Quarterly* 18 (1991), pp. 1-42.
3. See James McCarthy and Mark Reisch, *Hazardous Waste Fact Book*, (Washington, DC: Congressional Research Service, 87-56 ENR, June 30, 1987) and U.S. Office of Technology Assessment, *Technologies and Management Strategies for Hazardous Waste Control* (Washington, DC: Summary, OTA-M-197, March 1983).

4. This and the other market-based mechanisms considered in this article are described in much greater detail in Robert N. Stavins, ed., *Project 88—Round II: Incentives for Action: Designing Market-Based Environmental Strategies*, a public policy study sponsored by Senator Timothy E. Wirth, Colorado, and Senator John Heinz, Pennsylvania, Washington, DC, May 1991.
5. See Haynes C. Goddard, "Economic Incentives for Managing Household Solid Waste: Upstream Versus Downstream Policies," paper presented at Conference on Research Developments for Improving Solid Waste Management, sponsored by the Air and Waste Management Association and EPA, Cincinnati, February 4, 1991, and Peter S. Menell, "An Incentive Approach to Regulating Municipal Solid Waste," paper presented at the John F. Kennedy School of Government, Harvard University, March 20, 1991.
6. See, for example, Seattle Solid Waste Utility, Public Information Department, *Municipal Solid Waste Management Program Description*, Seattle, 1991.
7. See Robert N. Stavins and Christopher Wolz, eds., *Incentive-Based Policies for Municipal Solid Waste Management, Summary of Workshop Proceedings, May 16, 1991*, John F. Kennedy School of Government, Harvard University, Center for Science and International Affairs, Project 88—Round II Discussion Paper #91-7, September 1991.
8. See Peter Menell, "Beyond the Throw-Away Society: An Incentive Approach to Regulating Municipal Solid Waste," *Ecology Law Quarterly* 17 (1990), pp. 655-739.
9. See Terry M. Dinan, "Implementation Issues for Marketable Permits: A Case Study of Newsprint," paper presented at the John F. Kennedy School of Government, Harvard University, November 20, 1991.
10. For a detailed investigation of deposit-refund systems, see Peter Bohm, *Deposit-Refund Systems: Theory and Applications to Environmental, Conservation, and Consumer Policy* (Baltimore, MD: Johns Hopkins University Press, 1981).
11. For additional discussion of this point, see Clifford S. Russell, "Economic Incentives in the Management of Hazardous Wastes," *Columbia Journal of Environmental Law* 13 (1988), pp. 257-274.
12. For an analysis of alternative instruments (including a deposit-refund system) for addressing the lead-acid motor vehicle battery disposal problem, see Hilary Sigman, "A Comparison of Public Policies for Lead Recycling," unpublished paper, Department of Economics, Massachusetts Institute of Technology, Cambridge, Massachusetts, November 1991.
13. A problem inherent in either approach, however, is the increase in incentives for battery theft. The higher the deposit, the greater the incentive for theft, particularly if one only needs to show up at a redemption center with a battery to claim a refund. An alternative would be to require a sales receipt upon redemption or to permit refunds only for those exchanging an old battery for a new one. Either of these alternatives, however, would reduce the program's comprehensiveness. In any event, a deposit of $2 to $5 per battery, for example, would be greater than the typical market value of used batteries. Such a deposit should be small enough to avoid much of the theft problem but large enough to encourage a substantial return.