Chapter 1

Executive Summary

Contents

Tables

Executive Summary

The Problems and the Opportunities

The United States annually generates more than 135 million tons of municipal solid waste (MSW). Its disposal is a rapidly growing problem for many areas of the country, where such traditional methods as open dumping, landfill, uncontrolled incineration, and ocean burial are too expensive or environmentally unacceptable. At the same time, MSW contains over two-thirds of the national consumption of paper and glass, over one-fifth of the aluminum, and nearly one-eighth of the iron and steel. If burned, the combustible portion of this waste would be equivalent to about 1.9 percent of the Nation's annual energy use.

Resource recovery and recycling materials and energy from MSW can play significant roles in helping to solve waste generation and disposal problems. In addition, resource recovery, recycling, and reuse can contribute to the wise and efficient use of materials, to conserving energy, to preserving the environment, and to improving the balance of trade by reducing our dependence on imported natural resources. By using materials more than once, virgin resources can be conserved for ourselves and for future generations.

This report addresses important questions that have arisen about the feasibility of various approaches to resource recovery, recycling, and reuse. It presents the results of an examination of influential technological, economic, and institutional factors, Federal policies that might stimulate resource recovery, recycling, and reuse were identified and their effectiveness and impacts were assessed, The criteria used for assessing the policy options include technical and administrative feasibility (effectiveness), economic efficiency, equity, security, and diversity.

Only those problems and opportunities associated with the disposal of ordinary MSW in the United States have been studied. The management of hazardous wastes, sewage sludges, and other special wastes; remanufacturing, reworking, or refurbishing products for reuse; recycling industrial scrap; and recovering materials or energy from agricultural, forestry, mining, or industrial residues, have all been specifically excluded.

The Current Federal Role in the Management of MSW

Direct Federal involvement in solid waste disposal, resource recovery, recycling, and reuse has evolved through three major Acts:

- The Solid Waste Disposal Act of 1965,
- The Resource Recovery Act of 1970, and
- The Resource Conservation and Recovery Act of 1976 (RCRA),

All of these Acts have been motivated by a concern for the public health and the environmental impacts of improper disposal, by the rising costs of disposal by traditional means, and by the recognition that municipal wastes contain valuable materials and energy. Each emphasizes that the primary responsibility for municipal waste collection and disposal rests at the local level. All have provided for Federal roles in research, development, and demonstration: technical assistance; information dissemination; and grants to State and local governments for planning for solid waste management. RCRA makes such grants conditional on the adoption by a State of a series of programs designed to upgrade land disposal and facilitate resource recovery. It also provides for the Federal procurement of recycled materials and for Federal involvement in developing performance standards for recovered materials and energy in order to assist in developing markets for them.

While reaffirming limited Federal involvement in resource recovery and recycling, RCRA has recognized the possibility of future Federal policy initiatives by creating the Cabinet-level interagency Resource Conservation Committee to examine continuing resource conservation issues.

The Federal Government has played a less direct, although significant role, in influencing the supply and demand for recovered materials and energy through policies on air and water pollution control, railroad rate regulation, materials taxation, control of ocean waste disposal, and use of public lands.

Issues and Findings

The findings of this study are summarized in the following pages, grouped under five major issue areas:

I. Methods for resource recovery (p. 5).
II. The marketability of recovered resources (p. 9).
III. Institutional barriers to resource recovery and recycling (p. 12).
N. Incentives for resource recovery and recycling (p. 14).
v. Beverage container deposit legislation (p. 16).

Issue Area I

Methods for Resource Recovery

Materials may be recovered from MSW for recycling in two ways: by collecting wastes that have been kept separate as they are generated ("source separation"), and by separating mixed wastes in a central facility ("centralized resource recovery"). Energy is saved using either method, since less energy is used in manufacturing products from recovered materials than from virgin raw materials. In addition, with centralized resource recovery energy can be recovered as fuel from the organic components of MSW.

A number of technologies for centralized resource recovery have been brought to various stages of development. Each has different technical and economic performance characteristics. Source separation, which is designed to recover specific components of the waste stream, can be organized in several ways. This report describes both of these methods and assesses their status and capabilities.

1 What is the status of source separation in the United States?

Source separation for the recovery of recyclable materials from MSW is widely practiced in the United States today. It is the only available method with which wastepaper can be recovered for recycling into new paper products. It is also used to recover glass, ferrous and nonferrous metals, and yard waste. Nearly all of the MSW now recovered for recycling is collected in source separation programs.

The types of source separation programs currently operated by municipalities, industry, and volunteer groups include curbside separate collection programs, multimaterial recovery in community recycling centers, industry-sponsored recycling programs, and commercial and industrial methods of source separation. According to the Environmental Protection Agency, about 133 communities were collecting newspapers in curbside programs in May 1978. Another 40 were collecting other kinds of paper and/or glass and cans. Industry-sponsored programs collected 25 percent of all aluminum beverage cans produced in 1977.

Source separation has grown in popularity in the last decade. However, some programs have experienced technical or organizational problems, many others have failed owing to problems in marketing their products, and still others have faced indifference or hostility from proponents of alternative approaches. Nevertheless, a great deal of expertise has been developed for designing and operating such programs. Much of the curbside collection activity has taken place in small towns and moderate-sized cities. A residential source separation program encompassing a major urban area has yet to be demonstrated. (Chapter 4)

2 How effective is source separation?

The success of source separation programs depends on obtaining and maintaining a high degree of cooperation and participation on the part of those who generate the waste. Source separation can produce sizable revenues and energy savings from MSW, but has only a limited effect on the total solid waste stream. For example, at 50-percent participation, a comprehensive residential and commercial program could recover around one-fourth of a community's MSW and earn revenues of $5 to $12 per ton of waste generated. But, three-fourths of the MSW would remain for recovery or disposal by other means. With such a program in place, a community would still have ample opportunity to install a centralized system to recover materials and/or energy. (Chapter 4)

3 Would source separation in a community detract from efforts to recover energy and materials in a centralized facilit y?

Source separation removes some MSW components that a centralized resource recovery plant would rely on for fuel and, depending on its design, for recoverable materials. Consequently, it has the potential to reduce the revenues of an existing resource recovery facility. For this reason, capital-intensive, centralized systems should be designed to accommodate existing or future separate collection programs, thus reducing the possibility of revenue problems. Depending on the level of participation and on market conditions, a carefully planned combination of source separation and centralized resource recovery may be the optimal approach from an economic point of view. (Chapters 4 and 6)

4 How should Federal policy toward resource recovery and recycling treat source separation?

Nearly every potential Federal action discussed below, which encourages resource recovery or recycling, would stimulate source separation activities unless specific barriers to it are raised. Therefore, Federal programs, including assistance to State and local governments for solid waste planning, should be designed to incorporate source separation as a local option.

Federal efforts to assist source separation activities could include funding for research on collection systems, for innovative program design, and for improving equipment used in intermediate processing to upgrade collected materials for recycling. Federal assistance is needed to implement and maintain a demonstration program for curbside source separation in a large city. If such a program were successful, other major urban areas would be shown what could be done and how to do it. (Chapter 4)

5 What is the status of technologies for centralized resource recovery for energy and materials?

A number of technologies for burning the combustible portion of MSW or for converting it to solid, liquid, or gaseous fuels are at various stages of development. Techniques have also been developed, with differing success, for recovery of ferrous and nonferrous metals, aluminum, glass, and paper fiber.

The only commercially operational methods for recovering energy are waterwall combustion and small-scale modular incineration to produce steam, and the production of refuse-derived fuel (RDF) by wet and dry processes. The only commercially operational technologies for recovering materials from mixed MSW are the magnetic recovery of ferrous metals, the recovery of low-grade fiber by wet separation, and the production of compost by natural processes. Aluminum and glass recovery are being actively developed as is energy recovery by both anaerobic digestion and pyrolysis. (Chapter !5)

6 How much does centralized resource recovery cost?

Processing MSW in centralized resource recovery plants to recover energy and materials has been estimated to cost between $15 and $32 per ton of waste, depending on the technology used. Revenues from the sale of energy and materials can range from $5 to $17 per ton of waste, with more costly systems generally producing greater revenues. Most of the revenues come from the sale of energy.

Because revenues are generally insufficient to cover the costs of centralized resource recovery, plants must charge a price for waste disposal to make up the difference. This charge is commonly called a “tipping fee. ” For technologies now being considered, including small-scale modular incinerators, tipping fees are estimated to range from $3 to $21 per ton for plants able to process 1,000 tons of MSW per day. (Tipping fees at existing commercial plants range from $6 to $16 per ton.) Tipping fees for waste disposal at landfills typically range from $2 to $10 per ton nationwide. Therefore, in many parts of the country landfill is still the most economical way to dispose of waste. Consequently, resource recovery has the greatest potential where both landfill costs and energy prices are high, such as in the urban Northeast. [Chapter 6)

7 What is the energy potential of centralized resource recovery?

Energy can be recovered by centralized resource recovery either as fuel or as heat and also as the energy savings that accrue from recycling materials. As an upper limit, the total recovery of all the energy in MSW would be equivalent to about 1.9 percent of the Nation's current annual energy consumption. Recycling all of the iron and steel, aluminum, copper, and glass could save about 0.4 percent more for an upper limit on total savings of the equivalent of 2.3 percent of current energy use. Thus, centralized resource recovery could play a small, but not insignificant role in conserving energy. Technical, economic, and institutional factors, however, will keep the amount of energy saved by resource recovery in the foreseeable future to a fraction of its potential. (Chapter 5)

8 Are there environmental problems with centralized resource recovery?

Relatively little is known about the effluents from operating centralized resource recovery plants or about the nature and degree of workplace hazards they may present. This is largely because there has been little opportunity to gather data, and because there is considerable variability in and ignorance about the composition of both MSW and the recovered products. A number of studies currently underway should produce information about air and water emissions, bacteria and viruses in the plant environment, and toxic substances in all media including solid residuals. Authority exists for regulating these workplace and environmental problems, if needed. Should activity in centralized resource recovery continue, it will be desirable to step up research and to promulgate regulations needed to control any potentially harmful side effects. (Chapter 5)

9 How large should centralized resource recovery plants be?

The optimal design of a centralized resource recovery pIant, or a system of several plants, represents a tradeoff among three factors: (1) processing costs per ton, which decrease as plant size increases; (2) transportation costs per ton from collection points, which increase as plant size and haul distances increase; and (3) energy and materials revenues, the energy portion of which are site-dependent. For each service area there is a lowest cost mix of plant sites and sizes. This is determined largely by the tradeoff between the cost of transportation and the economies of scale in processing costs. Early enthusiasm for very large plants capable of processing 3,000 to 6,000 tons of MSW per day has diminished as such facilities have encountered difficult institutional problems. Moreover, the best available current information suggests that plants in the 1,000-to 1,5000-tpd range maybe the largest economically optimum sizes for most locations. In some communities plants as small as 50 to 200 tpd may prove to be the most satisfactory. (Chapters 5 and 6)

10 How does the nature of energy markets affect the best plant size for centralized resource recovery?

Only electric powerplants, large factories, or large complexes of office buildings can consume all the energy output of a l,000-tpd resource recovery facility. These types of potential customers have proven difficult to reach by proposed resource recovery projects. Electric utilities, which were once seen as major potential users of energy from MSW, have been less than enthusiastic. This is largely because using refuse-derived energy presents certain technical difficulties and also because current approaches to rate regulation offer no incentive to try it. Furthermore, in a given service area, MSW can provide only a few percent of the fuel needs of an electric utility. Thus, utilities have been reluctant to contend with the numerous technical and institutional problems just to obtain a minor part of their total fuel needs.

On the other hand, there area large number of potential customers such as office buildings, institutions, and factories for smaller quantities of refuse-derived energy. Smaller resource recovery plants in the 25-to 600-tpd range might adequately serve their energy needs. Furthermore, some of the problems that arise when several communities attempt to regionalize in order to build large plants would thus be avoided. Smaller resource recovery plants, which are more common in Europe, might feature direct incineration to produce steamer hot water and forego materials recovery altogether. They might also permit a more flexible approach by making it possible for a community or region to adopt resource recovery gradually rather than all at once.

However, not enough is known about the environmental and workplace health implications of operating a network of small plants scattered throughout a region. Also, more needs to be known about the energy demand characteristics of potential industrial, commercial, and institutional customers, in order to learn whether they can indeed become major consumers of energy from waste. (Chapters 5 and 6)

11 How can the Federal Government most effectively fund additional research on centralized resource recovery technologies?

Over the past 15 years, there have been a number of federally funded research, development, and demonstration projects concerned with centralized resource recovery. There has also been vigorous activity in the private sector. The Federal R&D presence would be most effective in identifying, evaluating, and controlling environmental and occupational problems; in characterizing materials; in funding basic studies of processes for size reduction, materials separation, combustion, and chemical reaction; and in exploratory design—particularly of small-scale systems for processing and using recovered materials and energy. The remaining technical problems can probably be solved most effectively by private firms in the course of commercial development. (Chapter 5)

Issue Area II

The Marketability of Recovered Resources

Substantial amounts of various materials and types of energy can be recovered from MSW today using either centralized separation and recovery or source separation. The quantities of recoverable resources will continue to grow in the future as materials use grows, barring major Government action or other events that would restrict the production and use of materials generally. Such recovered resources compete both with virgin materials and energy, and with secondary materials from other sources. Thus, in order to ascertain whether resource recovery can be widely implemented, it is necessary to examine factors that affect the marketability of recovered materials and energy. These include their prices and qualities, the influence of transportation costs, and the role of Federal policy.

12 Would materials and energy recovered from MSW be marketable?

Productive uses can be made of recovered iron and steel, aluminum, paper, glass, and energy with existing technologies and in existing facilities. Potential markets exceed any anticipated level of recovery today and through 1995 for iron and steel, aluminum, and paper. Glass markets are developing rapidly as the technical feasibility and economic, environmental, and energy advantages of producing containers from waste glass become evident. Energy markets far exceed the potential level of recovery from MSW nationwide. However, the prices that users are willing to pay and the product quality they demand could be barriers to the profitable sale of large amounts of recovered resources, if resource recovery were widely adopted. Furthermore, certain forms of energy including RDF, steam, and low-Btu gas must be produced near their customers if transportation costs are to remain acceptable. (Chapter 3)

13 Would recovered resources from MSW disrupt existing markets for secondary materials and energy?

At any foreseeable level, resources recovered from MSW would be unlikely to affect existing markets for secondary, or scrap, iron and steel. High levels of additional aluminum and paper recovery would add substantially to the current trade and could be disruptive. Since current trade in scrap glass is quite limited, glass recovery essentially represents creation of an entirely new market rather than disruption of an existing one. In view of the current energy situation and the relatively small amounts of energy recoverable from MSW, recovered energy would not pose a threat to established energy markets. (Chapter 3)

14 What prices can be expected for recovered materials and energy?

Typical prices for recovered materials and energy are shown in table 1. Since there has been little or no commercial trade in some of these commodities, the prices are somewhat speculative. They are based on the judgments of informed observers. Prices for recovered ferrous metal, aluminum, and paper are likely to fluctuate widely over time as do the prices for these materials today. (Chapter 3)

15 Would a Federal stockpile stabilize markets for recovered materials?

Established markets for secondary iron and steel, aluminum, and paper exhibit wide variations over time in both prices and quantities traded. The prices both for postconsumer aluminum cans and for newspaper obtained through separate collection programs have been more stable because primary aluminum companies have been offering stable prices to recyclers and because there are established long-term contracts for delivering waste

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Table 1.—Typical Prices and Gross Revenues for Recovered Resources Delivered to Market

Resource type	Delivered price[a]		Potential gross revenue[b] ($/ton of MSW)
From centralized resource recovery			
Iron and steel	15-40	$/ton	1.05-2.80
Glass	10-20	$/ton	0.45-0.96
Aluminum	300	$/ton	1.20
Other nonferrous metal	100-200	$/ton	0.10-0.20
Dry fuel (RDF)	0.50-1.00	$/million Btu	4.50-9.00
Steam	1.80-3.00	$/1,000 lb	8.55-17.10
Medium-Btu gas	[illegible]	$/million Btu	9.00-18.00
Electricity[c]	1.5-3.5	¢/kWh	6.00-14.00
From source separation			
Newspaper	20-45	$/ton	0.66-1.46
Books and magazines	5-20	$/ton	0.05-0.23
Corrugated paper	15-45	$/ton	0.70-2.07
Office paper	75-120	$/ton	1.43-2.28
Steel containers	20-40	$/ton	0.40-0.80
Glass containers[d]	20-30	$/ton	0.92-1.38
Aluminum containers	300	$/ton	0.80

[a]Source: OTA estimates from various industry sources.
[b]Based on typical amounts recoverable. Must be reduced to account for freight costs.
[c]Wholesale prices.
[d]Color sorted.

newspaper to recycled newsprint mills. Current trade in waste glass is small but growing rapidly, with relatively stable prices. A brief anaysis of a Federal stockpile for recovered resources suggests that this would be an ineffective, unnecessary, or overly expensive mechanism for stabilizing markets for materials recovered from MSW. (Chapter 3)

16 Can Federal procurement policy improve markets for recovered materials?

Federal procurement policy can strengthen markets for recovered materials by emphasizing their use and by eliminating arbitrary barriers to them. Existing General Services Administration regulations under RCRA, if followed, represent a useful move in this direction. (Chapter 3)

17 Is Federal support for R&D on the uses of recovered materials adequate?

Federal R&D support on the uses of recovered resources, as opposed to their production, is limited. Such research might find new uses and improve old ones, and is easily justifiable on economic grounds. Under RCRA, only the Department of Commerce has authority for such support, and that authority has not been funded. The Bureau of Mines has done limited work in this area under its basic authority. Additional Federal support for R&D on the uses of recovered resources appears to be desirable. (Chapter 3)

18 Is additional Federal action needed to support the development of specifications for recovered resources?

Specifications for the quality of recovered resources are needed mainly to facilitate trade. They are not required for the purpose of protecting consumers because few recovered resources reach consumers without further industrial processing. (Important exceptions are flammability standards for cellulosic insulation, recently established on an emergency basis by an Act of Congress, and health and safety standards for reusable beverage containers.)

Existing specifications promulgated by the secondary materials industries and based on the origin of secondary materials appear to be adequate to support trade in separately collected iron and steel, aluminum, and paper. Separately collected glass is currently traded under quality/price negotiations for each shipment. Composition specifications to facilitate trade in materials and energy from centralized resource recovery plants are currently in the final stages of development by a committee of the American Society for Testing and Materials. In view of the current state of activities concerned with voluntary standards there seems to be no need for Government action beyond that authorized under RCRA. However, funds appropriated for this purpose have not been adequate. (Chapter 3)

19 How significant are transportation costs in the economics of resource recovery?

Freight rates for transporting recovered materials and certain forms of recovered energy to markets can seriously impair the economics of resource recovery. For example, for shipments by rail in the 200- to 400-mile range, railroad freight rates can range as high as 25 to 80 percent of the gross income from the sale of waste iron and steel, paper, and RDF. Even a 50-percent reduction of freight rates for these resources would still leave freight charges a substantial cost factor. (Chapter 3)

20 Do railroad freight rates discriminate against secondary materials as compared with virgin ones?

The question of whether existing railroad freight rates discriminate against secondary materials was examined using several models of transportation ratemaking. Such discrimination was found to be sizable for iron and steel, aluminum, paper, and glass under cost-based rates (both variable and fully allocated cost approaches) and for paper and glass under the chemical equivalency approach to value-of-service rates. Such discrimination was not found under the value-of-service approach to rates. This examination has shown that part of the long-standing controversy over discrimination against secondary materials arises from different assumptions about how rates ought to be set. (Chapter 3)

21 What effect would adjustment of freight rates have on shipments of secondary materials and on railroad revenues?

The amounts of secondary iron and steel, aluminum, and paper shipped by railroad are not very sensitive to freight rates, and large changes in rates would have little effect on shipments of these materials. Therefore, if freight rates for secondary iron and steel, aluminum, glass, and paper were to be adjusted downward (on the order of 30 to 50 percent) to eliminate the greatest degree of discrimination found using any of the ratemaking models examined, an economic model projects that increases in rail shipments for iron and steel, aluminum, and glass would be small—on the order of only a few percent. Glass shipments might increase by as much as 15 to 25 percent. Correspondingly, railroad revenues in each case would decline substantially since revenue losses from existing traffic would not be offset by revenues from traffic growth. (Chapter 3)

22 Should railroad freight rates for secondary materials be adjusted?

Regardless of the projected small increases in shipments and the large decreases in railroad revenues, however, secondary materials appear to be treated unfairly by existing freight rates in the case of iron and steel, aluminum, wastepaper, and glass. Both equity and economic efficiency argue for their adjustment. Railroad revenues, if inadequate, could be adjusted by general rate increases. (Chapter 3)

Issue Area III

Institutional Barriers to Resource Recovery and Recycling

Institutions are important in establishing or removing barriers to the emergence of centralized resource recovery, which is a new, uncertain and, therefore, risky technology for disposal of MSW. Many institutional barriers originate in the mixed system of Federal, State, and local governments. Therefore, policies must be designed to circumvent these barriers rather than to remove them. This study examined four classes of institutional problems: information problems, jurisdictional problems, implementation problems, and marketing problems. They are listed in table 2.

Table 2 [illegible]

Information Problems
- [illegible] in research and development.
- [illegible]

Jurisdictional Problems
- Fragmented and overlapping State and local jurisdictions.
- Cost-sharing among jurisdictions.
- Mixture of private and public roles in managing MSW.
- Responsibility for and ownership of waste after discard ("flow control").
- Limitations on interjurisdictional waste shipment or disposal.
- Overlapping Federal agency jurisdictions.

Implementation Problems
- Limited capability of local governments to issue bonds.
- Cooperation of local waste collectors and haulers.
- Creation of local monopolies.
- Insufficient definition of health, safety, and environmental standards for resource recovery plants.
- Siting of facilities.

Marketing Problems
- Inadequate or nonexisting standards of performance for recovered products.
- Limited authority of local governments to enter into long-term sales contracts.
- Electric utility rate regulation that discourages use of new fuel sources.
- High freight rates for shipping MSW and recovered materials.

SOURCE:Office of technology

Resource recovery poses economic risks to potential investors. These risks arise from uncertainties in technical performance, in product marketability, in waste composition, and in institutional forces. Each party to a resource recovery effort quite naturally tries to minimize the risks he faces, yet such risk avoidance has a price for all the parties involved. Finding ways to share the risks that derive from the technical and economic uncertainties of resource recovery is a major source of its institutional problems.

Three broad approaches are available to the Federal Government to address institutional problems: direct Federal action, Federal incentives to reduce risk and uncertainty, and Federal inducements to State and local governments. OTA has not attempted to rank the seriousness of these problems or to evaluate the effectiveness of various approaches to their solution. All of the problems are important. A mix of approaches is required to resolve them if resource recovery is to be widely adopted.

23 Can the Federal Government take direct action to overcome institutional barriers to resource recovery?

Since resource recovery is largely a function of local government, the power of the Federal Government to directly effect change is somewhat limited. For example, it can overcome problems caused by inadequate information by providing technical assistance to local governments, if such assistance is competent and unbiased. Congress could also consider legislation to ensure that resource recovery facilities are ruled eligible for pollution control revenue bond financing. Actions discussed in other issue areas would also be constructive, including promulgation of environmental and health standards for resource recovery (issue 8) and adjustment of railroad freight rates for secondary materials (issues 20 to 22). (Chapter 7)

24 Is there a role for the Federal Government in overcoming the risks of resource recovery?

Carefully designed Federal subsidy programs can help overcome the risk barrier faced by private entrepreneurs or public agencies when introducing new resource recovery technologies. Such a use of subsidies is conceptually different from their use to make projects appear economically feasible which otherwise would not be. The first use of subsidy for resource recovery is clearly justified, the second less so. (See also issue 26.) (Chapters 6, 7, and 8)

Federally funded research and development can also help overcome risks and solve the institutional problems that risk sharing creates. (See issues 4, 11, and 17.) (Chapters 3,4, and 5)

25 How important is Federal action to induce regional planning for resource recovery?

The Resource Conservation and Recovery Act of 1976 is strongly based on inducing States to institute regionalized planning for solid waste management. This approach makes sense if large-scale regionalized resource recovery offers sizable economic advantages through economies of scale both in processing wastes and in selling recovered energy. In view of recent trends toward small-scale resource recovery systems and in view of the difficulty of marketing large amounts of recovered energy, especially to electric utilities, the importance of regional planning for disposal of MSW has lessened. Federal efforts should allow for a great diversity of State and local approaches to the management of MSW. (Chapter 6)

Issue Area IV

Incentives for Resource Recovery and Recycling

The Federal Government could adopt any of a number of policies designed to improve the economics of resource recovery and recycling. These include policies designed to increase the supply of recovered materials, such as subsidies for building or operating resource recovery facilities, as well as policies designed to stimulate the demand for recovered resources by influencing the competition between virgin and secondary materials and energy.

Incentive policies are based on three general rationales. First, they can be designed to stimulate desired private resource recovery activity if such activity has been inadequate due to the fact that its net social benefits exceed its net private ones. Second, incentives can be designed to offset institutional barriers to resource recovery or to offset incentives already extended to competing virgin resources. Third, incentives can be designed to help overcome the risks that pioneering adopters face when trying a new, uncertain technology.

26 How necessary or desirable is Federal subsidy to increase the supply of recovered resources?

Subsidizing the capital or operating costs of centralized resource recovery nationwide cannot be justified on the basis of the economic value of the recovered energy or materials. For example, a subsidy of $8 per ton of MSW, which is designed to make an average $14 per ton resource recovery tipping fee competitive with an average $6 per ton landfill tipping fee, is equivalent to a subsidy for recovered ferrous metal of several times its market price or to a subsidy for recovered energy of nearly $1 per million Btu (about $5 per barrel of oil equivalent). There is no a priori reason to subsidize resource recovery, if sound alternative disposal methods, such as landfill with adequate environmental controls, are available at a lower cost.

Resource recovery does not generally need a Federal subsidy if the revenues from recovered energy and materials plus landfill credits exceed its costs. A subsidy may be economically justified, however, in three specific circumstances: (1) if the environmental and health costs of alternative disposal methods such as landfill or ocean dumping exceed the subsidy, and it is not feasible to reduce those costs through regulation and control; (z) if the spread between the resource recovery and the landfill tipping fees is considerably less than $8 per ton, and a subsidy is justified by a desirable but nonmonetary benefit of energy recovery such as reduced oil imports; or (3) if a subsidy for a small number of demonstration plants is used to compensate communities for bearing the risks associated with trying an uncertain new technology that might benefit the rest of the Nation. Federal subsidy for the first two purposes can be justified economically only if local areas cannot afford proper disposal of the wastes they generate. Federal subsidy for the third purpose is reasonable from an economic point of view. (Chapter 6)

27 What steps might the Federal Government take to affect the competition between virgin and secondary materials in order to stimulate demand for recycling?

This study has examined the potential effectiveness of five economic policies for stimulating recycling and reducing the rate of MSW disposal. They are:

The Product Charge—an excise tax levied on material goods proportional to their weight, volume, or other measure of disposal cost. The tax would be levied on material fabricators or related industries.

The Recycling Allowance—a direct grant or tax incentive to producers or users of recycled materials paid in proportion to some measure of the amount or value of recycled materials used.

The Severance Tax—a tax on virgin materials levied at the point of mining or harvest in proportion to some measure of the amount or value extracted.

The Percentage Depletion Allowance—existing law allows for deduction from income before taxes each year of a percentage of gross income from mining specified minerals. Repeal of this deduction was examined.

The Capital Gains Treatment of Income From Standing Timber—existing law allows for taxing income from the sale of standing timber at rates appropriate to long-term capital gains, which are lower than rates for ordinary income. Repeal of this tax preference was examined. (Chapter 8)

28 Which of the incentive programs for recycling might work best?

From equity, economic efficiency, and administrative perspectives, removing existing tax preferences for virgin materials is preferable to establishing new ones for recycled materials. From the perspectives of resource recovery, recycling, and reduced generation of waste, the key question, however, is the effectiveness of various proposals in stimulating recycling and decreasing the waste disposal burden,

Of the five policies considered, the product charge and the recycling allowance are projected to be the most effective for these purposes if they could be made to work. However, the effectiveness of the product charge would depend on the successful implementation of the exemption for recycled materials, but the administrative problems of the exemption may be so great as to render the charge concept unworkable. The recycling allowance faces similar administrative problems.

The analyses suggest that repeal of the percentage depletion allowance on hardrock minerals or repeal of the capital gains treatment of timber income would increase recycling by only a small amount. Furthermore, these actions are not expected to significantly reduce the generation of waste. (See also issue 29.) Nevertheless, these tax provisions do treat secondary materials unfairly in their competition with primary materials. (Chapter 8)

29 How much confidence is there in estimates of the effects of Federal incentives on recycling?

Only a small number of studies have been published on the response of recycling to economic policies, Further research and analysis are needed before there can be complete confidence in estimates of the effectiveness of Federal economic incentives in increasing either the demand for or the supply of recovered materials and energy. In particular, studies are needed concerning the influence of economic policy on plant investment decisions, including plant location, and on vertical integration in the materials industries to determine whether these effects serve to inhibit the use of recycled materials in the long run. Additional analyses are also needed to explore more fully the implications of these incentive policies for the nature of the competition between primary and secondary materials, and for the competition between domestic and foreign producers,

The incentive policies examined in this study may have side effects in such important areas as prices, profits, Government revenues, administrative costs, employment, foreign competition, and long-run materials and energy conservation. Further analysis in-depth is needed to arrive at a thorough understanding of the outcomes of each of these policies. (Chapters 6 and 8)

Issue Area V

Beverage Container Deposit Legislation

During the last 30 years the beer and soft drink industries have undergone a major shift from the use of refillable glass bottles to the use of nonreturnable glass and plastic bottles and metal cans. During the same period the sales of both beverages in individual packages have grown dramatically. One result of these trends has been that discarded beverage containers have become significant components of both litter and MSW. Beverage delivery has become more energy- and materials-intensive while employing fewer people and requiring less capital per unit of beverage consumed. Economies of scale in brewing, bottling, and transportation, especially using lightweight nonreturnable containers, have favored a trend toward centralization of bottling and brewing, with fewer producers and fewer brands available. Packaging has become a significant part of beverage marketing strategy, with a wide variety of package sizes and types available. Federal legislation has been proposed that is intended to slow the declining market share of beverages in refillable bottles, by imposing a mandatory, uniform, refundable deposit on each container.

30 Would Beverage Container Deposit Legislation (BCDL) work?

A review of a number of studies of BCDL sponsored by proponents, opponents, and neutral parties finds agreement that it would accomplish all of its major goals to some degree. It would lead to a reduction in litter, in MSW, and in consumption of energy and raw materials. For its proponents, it would serve as a symbol of a commitment to resource conservation, even though it would not save as much energy as such measures as energy efficiency standards for buildings and automobiles.

However, considerable uncertainty exists regarding the ultimate effects of BCDL on container market shares and on return and recycle rates. No one has devised a method for predicting these outcomes, which depend on market decisions by consumers and on the exercise of at least limited market power by producers and distributors. Nevertheless, experiences in the several States that have implemented BCDL, as well as the judgment of many informed observers, indicate that BCDL would lead to an increased use of refillable bottles and that containers would be returned at a sufficiently high rate to ensure that its goals would be achieved. (Chapter 9)

31 How much energy would be saved by BCDL?

If BCDL were adopted it is estimated that it would save the energy equivalent of 20,000 to 60,000 barrels of oil per day. However, the energy saved would be in the forms of naural gas, coal, nuclear energy, hydropower, and wood waste. Some studies find a savings of oil as well. Other studies project an increase in the actual consumption of oil of as much as 5,000 barrels per day including additional gasoline and diesel fuel for transportation. (Chapter 9)

32 How would BCDL affect industry and labor?

BCDL would have a number of significant side effects that are not intended by its proponents. It would increase the capital needs of beverage brewers, bottlers, wholesalers, and retailers. At the same time, it would severely disrupt the metal can and glass bottle industries with losses of output and jobs. Net employment and total compensation to workers would increase for the industries involved in manufacturing materials and containers, and in producing, delivering, and selling beverages. However, existing skilled jobs would be lost in materials and container production, while relatively unskilled jobs would be gained in wholesaling, transportation, and retailing of beverages.

The costs of BCDL would be concentrated in a small number of communities in which materials and container plants are located, while the benefits would be distributed throughout the country. Thus, Federal relocation, retraining, and other assistance should be considered for both workers and firms that might be harmed by BCDL. (Chapter 9)

33 How would BCDL affect consumers?

Unlike a ban on nonreturnable containers, BCDL would preserve the right of producers and consumers to choose among several package types, although the total number of available package types would decline. However, BCDL would ensure that users of nonreturnables pay the full cost of their disposal. It would also provide an incentive for recycling and against littering.

Under BCDL, the costs of containers per fill would decline due to the greater use of multitrip refillables, while other costs of delivery would increase. Available data do not permit a consensus judgment of the net effect of BCDL on total costs, or on the shelf prices of beer and soft drinks. Some authors project a decrease in costs and prices, others an increase. Data on current prices show that soft drinks are cheaper in refillables than in nonreturnable bottles and cans. There is some reason to believe that this might not be the case under BCDL if producers have to invest heavily in new equipment to meet an augmented demand for beverages in refillables.

The availability of beverages in refillable containers is expected to improve under BCDL, whereas the number of types of containers might decline. Depending on how consumers value the convenience of nonreturnables and refillables as well as on the uncertain price changes, beverage consumption might decline, but by a few percent at most. (Chapter 9)

34 What would be the impact of BCDL on health and the environment?

Refillable containers generally produce less air and water pollution and less industrial solid wastes than other container types on a per-fill basis. Litter-related injury from improperly discarded glass bottles would probably decline under BCDL. It is not possible to say with available data whether worker and consumer injury would increase or decrease. No evidence was found that refillable glass bottles pose additional health or sanitation hazards. (Chapter 9)

35 How might BCDL affect, or be affected by, new technology?

If BCDL were passed, new technology might emerge for managing refillable containers and for recycling nonreturnables. Government assistance might be needed to spur development of new, more efficient, standard refillable containers for use industrywide.

The growing popularity of the plastic soft drink bottle could drastically alter the soft drink package mix, whether or not BCDL is adopted. If made available in smaller sizes (10 to 16 ounces), plastic containers would markedly alter the projections of the effectiveness and the impacts of BCDL that are discussed in this report. (Chapter 9)

36 How would BCDL affect economic concentration in the soft drink and beer industries?

Since BCDL would decrease the economic advantages of centralized brewing, bottling, and wholesaling, the current trend toward a small number of large firms in beer and soft drink production might be slowed.

If upheld by the courts and not modified by Congress, the recent decision by the Federal Trade Commission outlawing territorial franchise restrictions for trademarked soft drinks in nonreturnable containers could lead to rapid concentration of that industry. The results would be an industry with only a few firms having a few large plants, as well as the rapid disappearance of the refillable bottle for soft drinks. By making the refillable bottle more attractive economically, BCDL could help preserve smaller, local bottlers. Legislation now under consideration to preserve the territorial franchise system could help maintain the refillable bottle's current market share.

The beer and soft drink industries are both complex. They are characterized by a mix of small and large firms, by regional and national markets, and by an extensive use of packaging alternatives as marketing and competitive devices. None of the major analyses of the effects of BCDL examined for this study has taken these structural complexities into account. In part, this reflects the limits of the art of policy analysis. It also contributes to the inherent uncertainty regarding the ultimate outcomes either of BCDL or of antitrust action taken against the industries. (Chapter 9)

37 How would BCDL affect government?

BCDL would cause some shift in tax revenues at and among the local, State, and Federal levels. This would happen due to changes in the mix of capital and labor used in the beverage-related industries and to changes in profits and wages. While BCDL uses the market approach to regulation and is nearly self-administering, some additional governmental resources would be needed to administer and police the deposit system. (Chapter 9)

38 Would BCDL harm centralized resource recovery or source separation programs?

Successful BCDL would reduce the amount of aluminum, steel, and glass in the solid waste stream. Thus, it might reduce the revenue of an existing centralized resource recovery plant by as much as 5 percent. There would be no revenue reduction at all if the recovery of aluminum and glass do not become technically and economically feasible. Systems such as waterwall incineration, which do not recover materials, would not experience a loss in revenues. (Chapters 5, 6, and 9)

Source separation programs are more dependent on revenues from materials recovery than is centralized resource recovery. Thus, BCDL might reduce the potential revenues of a residential source separation program for newspaper, glass, and cans by as much as 25 percent, or of a comprehensive program including all forms of paper and yard wastes by as much as 13 percent. (Chapters 4 and 9)

A Perspective on Further Federal Action

The disposal of MSW in an environmentally and economically acceptable manner is a chronic problem of our modern consumer society. Recovery, recycling, and reuse of the materials and energy in MSW can help solve the disposal problem and provide opportunities to conserve resources and protect the environment.

Like all of man's activities, resource recovery, recycling, and reuse have costs as well as benefits. This study of proposed Federal policies for waste management has not adopted the overly restrictive formalism of the cost/benefit approach. Nevertheless, it is reasonable to regard resource recovery, recycling, and reuse from an economic perspective and to urge that such programs make economic as well as political sense.

In the context of current costs, prices, and markets for materials, labor, and equipment, resource recovery is economically sound in some regions and not in others. In those regions where the cost of environmentally sound landfill or the price of energy is high, or the markets for recovered materials are strong, resource recovery and recycling make good economic sense. In other regions, landfill is still the economically and environmentally preferred alternative. Federal policy should be sufficiently flexible to accommodate different local conditions, and should encourage State and local governments to adopt the most economic and environmentally sound approach to waste disposal. The focus of Federal policy needs to remain on those areas in which the private market and State and local governments require the most assistance: protecting public health, preserving the natural environment, and supporting research and development on new technology.

This study has identified and examined a number of Federal policy options, each of which alone would make only a small difference to the economics of resource recovery and recycling. Taken all together, however, they could lead to a large increase in these activities. Ultimately, the widespread adoption of resource recovery and recycling may depend not so much on the objective analysis of small actions taken either together or separately, but on Federal action to create a climate in which the recovery, recycling, and reuse of discarded wastes becomes a valued way of life for all Americans.