Chapter8

Economic Policy, Waste Generation, and Recycling

Contents

Tables

Economic Policy, Waste Generation, and Recycling

Background

Issues and Scope

As noted in the introductory chapter, economic forces strongly influence the flow of materials through our society from resource extraction to waste disposal. This chapter examines how existing or proposed Government economic policies affect these forces. It also examines the effectiveness of such policies in reducing the rate at which wastes are generated or increasing the rate at which they are recycled. The specific policy instruments examined are:

- product disposal charge,
- financial incentives to industrial users of recycled materials,
- severance tax on virgin materials,
- percentage depletion allowance for minerals, and
- capital gains treatment of income from standing timber.

The analysis of the options in this chapter, which reviews their effectiveness in accomplishing the goals of waste reduction and recycling, is both partial and preliminary. It is partial because these policies could have important implications beyond the scope of this study. These include impacts on recycling materials from other sources such as junked automobiles and industry, as well as impacts on the industries, workers, and other parties involved. It is preliminary in that it reports on a review of a small number of studies carried out by organizations other than OTA, which itself has not done independent quantitative analyses of the effectiveness, costs, or impacts of the existing or proposed policies. Furthermore, for reasons outlined in chapter 2 and elaborated below, it is extremely difficult to do good econometric analyses of the impacts of economic policies on scrap materials markets, and predictions of such impacts are necessarily quite uncertain. (Economic policies directed at stimulating the supply of recycled materials through source separation and centralized resource recovery are discussed in chapters 4 and 7.)

Related Studies

Two major efforts are currently underway in the executive branch to analyze and recommend economic policy initiatives for materials. The Cabinet-level, interagency Resource Conservation Committee (RCC), mandated by the 1976 Resource Conservation and Recovery Act, expects to report on the following seven areas;

1. subsidies for resource recovery,
2. litter taxes,
3. severance taxes,
4. percentage depletion allowances for extractive resources,
5. capital gains tax treatment of timber income,
6. freight regulations, and
7. deposit and bounty proposals.(1)

In a closely related effort, President Carter has directed executive branch agencies to carry out a Domestic Policy Review of Nonfuel Minerals Policy under the chairmanship of the Secretary of the Interior and the Presidential Science Advisor.(2) Economic policies are expected to be a major focus. Furthermore, the Secretary of the Treasury was directed by an amendment to the Inter-

nal Revenue Code to investigate and report on all provisions of the Internal Revenue Code that have an impact on recycling.(3) Their study has been delayed in the expectation of working through the Domestic Policy Review.(4)

Responses to Economic Policies Toward Materials

In this section, the responses of the materials system to economic policies are discussed as a basis for understanding the subsequent discussion of specific policy options. In addition, the most important side effects of these policies are presented.

For convenience, the responses of the materials system to economic policies are divided into primary responses, or effects on "materials flows, " and secondary responses, or "side effects. " The distinction rests on the intent of the policies, rather than the importance of their effects. In other words, since the goals of the policies are to reduce waste generation and increase recycling, these material flow responses are of primary concern. Any side effects of the policies could be equally or even more important but because they were unintended they are denoted as secondary responses.

Primary Responses: Materials Flows

Evaluation of the response of materials flows to economic policies is based on the principle that the rate of a material's consumption is influenced by its price, by the costs associated with its use, and by the prices and costs of using alternatives. (This is not to imply that prices and costs alone determine consumption. Institutional factors, for example, are also important. However, changes in consumption can be related quantitatively to small changes in costs and prices, at least in the short run.)

Five general responses might follow a change in the relative prices of materials. Suppose that there were a drop in the price of a recycled material relative to that of its virgin material counterpart. Furthermore, assume that all other prices and costs in the economy remain the same. The outcome might be any or all of the following:

1. Increased output from some industries that use the recycled material.
2. Substitution of the recycled material for the virgin material in certain applications.
3. Substitution of the recycled material for other materials in certain applications.
4. Substitution of the recycled material for other factors of production such as labor or capital in certain applications.
5. Development of new technologies or the emergence of new industries that use the recycled material.

In each of these cases, a different period of time would elapse before the response to the change in material price would take place. The above list is in order of increasing elapsed time. Responses that may take place over a period of several days to 1 or 2 years (the first three listed above), are said to occur in the "short run. " For example: (i) if the cost savings from using a recycled material are passed onto customers, an increase in output might occur within a few weeks because of a step-up in purchases; (ii) if existing equipment can be used, a recycled material can be substituted for a virgin material fairly quickly; and similarly, (iii) in the manufacture of certain products a recycled material can often be easily substituted for some other material. Responses that may take place over several months to several years (those of the fourth type) are said to occur in the "long run. " They usually involve making changes in capital equipment and in the work force in order to use more recycled material and less capital and labor. The fifth type of response to price change, technological innovation, usually occurs only in the "very long run. " It may take anywhere from 1 or 2 years up to 10 or more years to occur.

Analysts are best able to predict the responses of materials flows to price changes

for the "short run. " In fact, responses of the first type are the basis for most of the theoretical models on which analytical studies are founded. For example, input-output analysis, a widely used methodology, is based on the assumptions that both the technologies and the ratios of capital, labor, and materials use are constant over time. It is only applicable to responses of the first type. Analyses of "short run" responses of the second and third types are difficult to carry out because the nature of the available data does not permit making statistically reliable estimates that fit the theoretical models. This is also true for long-run responses of the fourth type. In the case of studies of technological innovation in response to materials prices (very long-run responses of the fifth type) at present good theoretical models, on which studies could be based aren't even available. (5,6) As a consequence of these analytical shortcomings, most of the studies that have been done probably underestimate the changes in demand that would ultimately occur in response to price changes.

Perception is often unreliable for anticipating the response of material demand to changes in the prices of recycled materials. As has been previously discussed (see chapter z) the short-run demand for a secondary material actually increases at the same time as its price is increasing. This is a consequence of the higher prices that scrap dealers can charge when the short-run demand for all materials is high. The resulting variation in short-run scrap prices tends to be greater than the price changes that take place in the long run thus it acts to impede understanding long-run scrap market behavior.

The "availability" of materials also tends to influence their relative flows in the economy, since users have a preference for materials that are more available. Availability is related to price response, but is less well-defined. In the short run, a material is perceived to be "available" if the supply is highly responsive to price; that is, if purchasers can buy all they need at or slightly above the normal price. If this is not the case, or is perceived not to be the case, the material is said to be less available. Such short-run availability is closely related to the ability of productive capacity to be easily and quickly expanded. In the long run, availability is related to the potential for actual exhaustion of the resource base, or, in the case of scrap, to exhaustion of the available scrap inventory. Political factors also affect perceived availability. For example, the existence or possibility of new environmental restrictions, labor actions, or international market disruption may adversely affect availability.

Secondary Responses: Side Effects

This section presents an overview of the less specific, broader side effects or secondary responses that might be expected from changing economic policies toward materials use. For the purpose of this analysis, the five primary, or materials flow, responses discussed in the previous section as well as the materials system model in figure 2 (see page 30) should be kept in mind.

In this general discussion of side effects, it is assumed that a policy is adopted that has the effect of reducing the cost of using recycled materials relative to using virgin ones. Adopting such a policy would have side effects in the following areas.

Prices—Material prices may change by less than the changes in cost caused by economic policies. For example, producers may be unable to pass through all of the cost increases, or may be unwilling to pass through all of the cost decreases, a policy might create. For example, a new tax on a virgin material might raise its costs of production by a certain amount, X. But, if the demand for that material is elastic, only a portion of the cost increase could be passed on. Thus prices might increase by less than X.

Profits—In the price change example just discussed, an industry's profits would decrease if all of its cost increases could not be passed through. On the other hand, if the policy decreased costs and prices, profits might

increase based on the increased sales. Similarly, a subsidy program, if not carefully designed, can provide extra profits on those sales that would have occurred without the subsidy. Such profits are commonly called windfall profits.

Government Revenues—If economic policies stimulate additional net economic activity, additional revenues may be generated that offset direct losses or augment direct gains. When new policies are adopted, the burden of taxation and the benefits of subsidies will shift among firms, industries, locations, points in time, and levels of government. The net effect of any particular policy on government revenues may be very difficult to predict and impossible to measure.

Government and Private Administrative Costs—The governmental and private sector administrative costs may be strongly dependent on the policy tool chosen. Taxation is a convenient way to administer incentives and disincentives, since they can piggyback on a preexisting system of recordkeeping, reporting, auditing, and enforcement. Using the tax system to implement incentives or disincentives may create the lowest private sector overhead costs. While taxation, as a policy, minimizes the need to make administrative decisions, it uses a system of considerable complexity. However, programs such as direct regulation, grants, loans, loan guarantees, and direct charges may require a more costly and cumbersome administrative structure. They may also be more prone to arbitrary decisions, error, court challenges, and bureaucratic inertia. But, incentive or disincentive policies implemented through the tax code are not subject to annual budget review, authorization, and appropriation. Therefore, they may be harder to amend or eliminate than are specific programs.

Foreign Competition-Policies designed to raise the costs of virgin materials might place domestic producers at a cost-price disadvantage compared with foreign suppliers of the same materials. Conversely, policies to reduce the costs of materials might open the United States to charges of unfair competition from foreign nations concerned that domestic policy might be used as a substitute for import duties.

Long-Run Materials and Energy Conservation—Depending on its nature and point of application, a policy may tend, over the long run, to increase or decrease the rate of extraction of virgin raw materials and the rate of consumption of energy. In the long run, any policy that reduces the apparent cost of recovering or using secondary materials and that does not affect the costs of virgin materials can be expected to increase the use of recycled materials and to have little effect on the use of virgin materials. In the short run, such a policy would tend to favor secondary materials. Over the longer run, however, it would make the use of all materials less expensive, on the average. Consequently, on balance, such a policy might even cause a small increase in the rates of extraction and ultimate disposal of materials. Conversely, policies that raise the relative costs and prices of virgin materials and that do not affect the costs and prices of secondary materials are likely to cause a reduction in the rates at which materials are extracted and ultimately disposed of. Such policies are also likely to encourage the recovery and recycling of materials from waste.

The energy required to process most virgin materials is greater than that required to process secondary materials. The exception is paper, for which energy use is sensitive to raw material choice and to whether energy from wood residues is counted as an energy input in virgin papermaking. The effect of each economic policy on energy consumption must be evaluated for the mix of virgin and recycled materials use that results.

Employment—The primary effect on employment of adopting policies to make secondary materials cheaper would be to stimulate employment both in recycling industries and in those that use materials. Policies to make virgin materials more expensive would increase employment in recycling industries

and decrease it in those using virgin materials. The net impact on these and all other industries would have to be evaluated for each policy.

Available Policy Options

A large number of options are available for changing the relative costs and prices of virgin and secondary materials. There are three major considerations in selecting a policy: (i) the policy instrument, (ii) the point of application of the instrument, and (iii) the factor of production to which the instrument would apply. The ultimate selection is, of course, a political judgment reserved to Congress. (Analytic guidelines for evaluating policies are discussed at the end of chapter z.)

Table 52 lists feasible policy instruments, points of application, and factors of production that might be considered in designing economic policy to stimulate materials recycling and reduce waste. If the strategy is to stimulate materials recycling by making secondary materials cost relatively less than virgin materials, only certain combinations of instruments, points of application, and factors of production are reasonable. For example, an income tax credit for the use of recycled materials by material fabricators is a reasonable choice. However, not all instruments apply to all factors. For example, neither construction grants nor accelerated depreciation can be tied to materials or labor inputs. They only apply to capital investment. Finally, since recycling is usually more labor intensive than producing virgin materials, tax credits for wages paid to the formerly unemployed might stimulate recycling.

Table 52.—Options in the Design of Economic Policy Toward Materials

Feasible policy instruments
Severance tax
Excise tax
Ad valorem tax
Income tax credit
Income tax deduction
Special tax treatment of income
Construction grant
Loan guarantee
Low interest loan
Accelerated depreciation
Output material subsidies
ad valorem
per unit of output (recycling allowance)
Input material subsidies
ad valorem
per unit of input (recycling allowance)
Product charge
Disposal fee
Landfill tax
Litter tax
Deposit
Bounty
Feasible points of application
Virgin material extraction
Basic material processing
Material fabrication
Product fabrication
Wholesaling
Retailing
Waste discard and collect ion
Waste processor/ recycler
Secondary material processor
Ultimate waste disposal
Feasible factors of production
Virgin materials
Recycled materials
Capital
Labor
Energy

The Effectiveness of Selected Policy Options

The effectiveness of five policy options in achieving the goals of (i) enhanced recovery and recycling of materials, and (ii] reduced rate of disposal of municipal solid waste (MSW) is discussed in this section. Each policy and its rationale are described, followed by a review of the expected impact of the policy on costs or prices, and by estimates of its effectiveness. The following five options are considered in detail:

- 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 Ievied on material fabricators or related industries.

- Financial Incentives to Processors or Users of Recycled Materials—Direct grants or tax incentives to processors or users of recycled materials paid in proportion to the amount or value of recycled materials used, or in proportion to the cost of capital goods used for recycling.
- 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 the deduction of a percentage of gross income from mining specified minerals from the income before taxes each year. In this analysis, modification or repeal is examined.
- 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. In this analysis modification or repeal of this tax preference is examined.

The product charge and user incentives are specifically designed to encourage recycling and discourage wasting materials. The severance tax has traditionally been used by States as a revenue measure, rather than as a recycling incentive. The percentage depletion allowance and capital gains treatment of income from standing timber are tax preferences designed to aid specific industries. Recycling was not originally a factor in establishing either of these policies.

The Product Charge

DESCRIPTION AND RATIONALE

The product charge is an excise tax or fee that would be levied on products destined to enter the waste stream after use. The rationale for this charge is that the user of a product should be aware of, and pay for, the cost of its proper disposal. Since product users do not pay directly for disposal, they have no incentive to recycle used products or to purchase goods that create less waste. The result is that users do not pay the full social costs of using products. The goal of the product charge is to include the cost of disposal in the original product price so that private costs will cover social costs. The intended outcomes are to stimulate recycling of used materials and to reduce the rate at which all materials are used.

A complete description of the product charge option requires specifying (i) the point of application, (ii) the amount and basis for the charge, (iii) the products to be covered, and (iv) the disposition of the revenues. The design of a product charge system would require considerable compromise between the ideal rationale and a working program. (See references 7 and 8 for extensive discussion of design issues.)

In principle, the disposal charge should be levied at the point of discard. In practice, however, solid waste management costs are paid as a flat fee or through general revenues. It is difficult to imagine how a system of direct charges proportional to the cost of disposal could be economically administered.

For maximum effectiveness, the charge should be applied either at the point of production or of purchase. However, this approach would require collecting it from a large number of producers or sellers. As a compromise the charge could be collected from bulk material producers. This would greatly reduce the number of collection points. It could, however, result in applying the charge to products not destined for waste, and could lead to charges on final products that are not related to the cost of their disposal.

The amount and basis for the charge is closely related to its point of application. Most proposals call for a charge that is proportional to product weight, as a measure of the cost of disposal. They also feature a separate charge by volume or by item for specific low-density items such as bottles and cans. The RCC staff analysis(7,8) suggests that such

a charge structure would result in some products bearing charges that are grossly out of proportion to their costs of disposal.

The selection of products to be covered is an additional question. In principle, all goods destined for waste should bear the charge. Studies for the Environmental Protection Agency (EPA) have focused on paper and packaging because (i) most of these products end up as MSW, (ii) they make up a considerable fraction of all MSW, and (iii) they lend themselves both to analysis of the effectiveness and to administration of a charge program.

Some groups have argued that other manufactured products as well as food and yard wastes should also be covered. Many manufactured products, however, do not become solid waste, and charging for food and yard wastes would be difficult.

An important feature of the product charge proposal is that recycled materials would be exempt from the charge. The rationale for the exemption is that discarded products that are recycled do not create a disposal cost. In the same sense that the product charge compensates for direct disposal charges, an exemption to the product charge for recycled raw materials compensates for their not creating a disposal cost.

The final question is what to do with the charge revenues, which could amount to several billion dollars annually. They could be treated as (i) general Federal revenue, (ii) returned to States and cities under general revenue sharing, (iii) returned to localities to support solid waste recycling activities, or (iv) returned to individuals as a tax credit or as a reduction in the personal income tax rates. There is no compelling theoretical reason to favor any of these approaches. The most prevalent suggestion is to support local recycling activities such as source separation or centralized resource recovery. Many private firms engaged in waste management are concerned that such funds may be used to compete with them unfairly.

EFFECTIVENESS OF THE PRODUCT CHARGE

The product charge might have two principal impacts on materials use and recycling. The first is that consumers would buy fewer products containing materials that will become waste, since such products would be relatively more expensive. The second effect would be to cause producers to substitute some recycled materials for some virgin materials, assuming that the exemption feature is retained. This would be done because the relative price of virgin materials would be raised by the amount of the charge, say $26 to $30 Per ton of material. Furthermore, this increased demand for recycled materials by producers would serve to stimulate recycling activities at the local level. On balance, then, virgin material consumption would decline, recycling activity would increase, and the rate of ultimate waste disposal would decrease. The likely magnitude of these changes is addressed in the following discussion.

Two analyses of the effectiveness of a product charge were carried out by Research Triangle Institute (RTI) for EPA (9,10,11). Both studies were designed to test the short-run impacts of the product charge; one on all packaging materials and the other on all paper products. In the packaging study, the charge was assumed to be $0.05 per container for nonpaper rigid packages and $26 per ton for all other packaging. In the paper study, the charge was assumed to be a uniform $26 per ton. Each study estimated the decline in the rate of waste generation due to consumer price increases as well as the increase in the rate of recycling due to improved markets for secondary materials. The sum of these two effects is the overall decline in the rate of ultimate disposal of waste.

Very recently, a study of the effectiveness of the product charge on paper products was performed by Franklin Associates, Ltd. (FAL) and by the International Research and Technology Corporation (IRTC) for the American Paper Institute (API). It was assumed that a charge of $30 per ton would be phased-in over a 10-year period beginning in 1980. They estimated the effects of the charge on de-

mand for paper, on recycling of paper, on solid waste generation, and on revenues in 1984, 1989, and 1999.(12)

The findings of the three studies are summarized in tables 53 and 54. RTI estimated that the product charge on packaging materials would have reduced the total MSW to be disposed of by 7.2 percent, and the charge on paper would have reduced MSW by 9.2 percent. Since these two categories overlap and the two studies were done somewhat differently, one cannot simply add these two results to get a more comprehensive estimate. However, they suggest that at least 10 percent, and probably more, of the waste stream would disappear as a result of the product charge. Since these are short-run analyses that cover only selected materials, the changes over a longer period of time could be considerably greater, but are more uncertain. These studies predict that the level of recycling from MSW might double if the product charge were adopted, in part because the current level is quite low.

In contrast, the study by FAL and IRTC found that a product charge on paper products would be much less effective than estimated by RTI, as shown in table 54. FAL's results suggest that the RTI estimates for a comprehensive product charge may be too high. Since the report for API was released shortly before the completion of this OTA study, it was not possible to make a careful comparison with the methods used by FAL/IRTC and RTI to explain the differences in their results.

Table 53.—Reductions in Postconsumer Solid Waste Resulting From a Product Charge on Packaging Materials in Base Year 1970
(thousand tons per year)

Packaging material	Waste reduction effect[a]	Resource recovery effect[b]	Total reduction
Paper and board	232	1,078	1,310
Plastics	40	0	40
Glass	216	4,078	4,294
Steel	238	2,532	2,770
Aluminum	8	244	252
Total materials	734	7,932	8,666
Percentage reduction in solid waste disposalc	0.60/0	6.60/0	7.20/.

SOURCE: RTI for EPA. (11)
aThe estimated reduction in material waste generation resulting from reduction of consumer purchases due to increased product prices.
bthe reduction in solid waste disposal attributable to increased material recycling.
c Based o,estimated 120 million tons of municipal solid Waste disposed Of in 1970,

One important implication of the three studies is that the product charge would have only a small effect, apparently on the order of 0.5 to 3 percent, on consumer purchases of materials (the "waste reduction" effect). The major impact of the product charge would be to stimulate resource recovery and recycling in order to meet the new demand from manufacturers for recycled materials. Therefore, if it proves infeasible to exempt the use of recycled materials from the product charge, this charge would not be effective in reducing waste loads or in reducing the rate of virgin materials use.

D1SCUSS1ON OF THE PRODUCT CHARGE

Consumer Price and Income Effects—RTI analyzed other implications of the product charge proposals. These are discussed in their original reports (9, Io) as well as in the EPA Fourth Report to Congress.(n) They found that consumer product price increases might range from a fraction of 1 percent up to several percent. The charge on packaging had a greater effect on price than the charge on paper, especially for goods in rigid containers, which bear a much higher charge per ton. The weighted average consumer price increase for products affected by the packaging charge was estimated at 0.3 percent. The largest price increases due to the charge on paper were 1.4 percent for newspaper and 1.7 percent for paper napkins and facial tissues.

According to the RTI analysis, annual charges would range from $8 for families in the lowest income group to $59 for those in the highest income group, with an average around $30. Depending on how the charge revenues are distributed, the product charge could be designed to be regressive or progressive on balance.

Table 54.—Reductions in Total Postconsumer Solid Waste Resulting From a Product Charge on Paper Products

Study	Year of full charge phase-in	Waste reduction effect[a] (percent)	Resource recovery effectb (percent)	Reduction in MSW for disposal[c] (percent)
RTI for EPA(11) . .	1975	1.4	7.9	9.2
FAL and IRTC for API (12)	1989	0.84	0.9	1.3

[a]The estimated reduction materials waste generation resulting from reduction of consumer purchases due to increased product prices
[b]The reduction in solid waste disposal attribution to increased material recycling
[c]Based on estimated 1282 million tons of net waste disposed of in 1975 and 1758 million tons in 1989

Feasibility of the Exemption for Recovered Materials—As noted above, the exemption for charges on recycled materials is the key to successful operation of the product charge. Without it the product charge would reduce waste generation and the use of virgin materials by only a few percent, and would have little or no effect on recycling.

Identifying and certifying secondary materials that qualify as recycled postconsumer wastes is a major difficulty in administering this exemption. A charge system would provide an incentive for producers to try to include prompt and home scrap as well as virgin material in the exempt classification. Beyond the clear possibility of fraud, however, technical problems exist. These include: (i) defining postconsumer wastes, (ii) following them through the secondary materials processing system, (iii) deciding whether wastes recovered in processing postconsumer wastes are themselves postconsumer wastes or home scrap, and (iv) treating imports and exports. The administrative burden of dealing with these issues for both Government and the private sector may outweigh any gains due to the charge.

Compatibility of the Product Charge and Other Approaches—A product charge would stimulate and support resource recovery and recycling options such as source separation and centralized resource recovery by stimulating demand for the kinds of materials these programs would produce. Furthermore, some proposals call for distributing the product charge revenues in order to pay for local resource recovery and recycling activities. This could be a problem, since extra costs for source separation arise mainly in collection rather than in recycling activities. The impact of the product charge on the generation of waste, as noted in tables 53 and 54, is not large enough to significantly affect the economics of resource recovery or source separation.

The product charge would be compatible with beverage container deposit legislation. (See chapter 9.) Since refillable bottles would bear the product charge only at the point of manufacture, a charge, of say $0.05, would be spread out over the trip life of the bottle. Cans and nonreturnable bottles made from recycled materials would likewise have to bear only a fraction of the $0.05 product charge per fill, on average, since they could receive the postconsumer waste exemption. The average product charge revenues would continue to pay the disposal cost for discarded containers, while the mandatory deposit would provide the disincentive to litter and the incentive to return containers.

Financial Incentives to Industrial Users of Materials Recovered From MSW

DESCRIPTION, RATIONALE, AND ADMINISTRATIVE OPTIONS

A variety of financial incentives could be offered to processors and other users of materials to induce them to select recycled rather than virgin materials as production in-

puts. * The economic rationales for such incentives are that they offset the tax and other incentives given to producers of virgin raw materials, and that they help to overcome existing institutional barriers to recycling. These incentives could be in the form of investment tax credits, direct grants, low- interest loans, or loan guarantees. Users of recycled materials could also be given incentives to employ persons to work with recycled materials. Recycling incentives could be offered to recycling firms, scrap processors, scrap dealers, or product fabricators. The selection of a policy would be based on effectiveness, administrative feasibility, and costs as well as on economic principles.

The administrative difficulties of identifying and certifying eligible postconsumer waste materials, which were previously noted to cause problems for the product charge, also present problems for recycling incentives. Eligible materials could be most easily identified at the recycling firm level (separate collector or resource recovery operator). There are a number of such firms, however, many of which are very small. The administrative burden of certifying eligible materials for these firms could be high. There are fewer scrap processors or dealers. However, the problems of distinguishing postconsumer from other scrap are highest at this level. Directing the allowance at product fabricators would require a detailed manifest system to ensure its proper allocation to postconsumer recycled materials, which at this point might be indistinguishable from, and mixed with, other recycled and virgin materials. There appears to be no way to avoid the cost of administering recycling incentives. Even with voluntary compliance the private sector would have the expense of keeping track of recovered materials.

*In the closing days of the 95th congress, the Energy Tax Act (Public Law 95-618 Stat. 3174) was passed, It contains a provision for an additional 10-percent investment tax credit (for a total of 20 percent) for the purchase of equipment used to recycle ferrous (with certain exceptions) and nonferrous metals, textiles, paper, rubber, and other materials for energy conservation.

THE EFFECTIVENESS OF THE RECYCLING INCENTIVES

Resource Planning Associates (RPA), under contract to EPA, analyzed the effectiveness of five specific programs of incentives to users of materials recovered from MSW. They estimated the impact that each would have on the extent of recycling from MSW, if these incentives were implemented in 1975.

Table 55 shows RPA's results for incremental waste recycling over the lo-year period from 1975 to 1985 for each of the op tions, along with the cost of their implementation. It also shows the results for 1975, the first year of the model programs. An incentive option's effectiveness would depend on its level, but RPA did not analyze this dependence. As can be seen from table 55, the most effective of the five options over the 10-year period is the 30-percent purchase price subsidy. But it is also the most costly to the Government. On the other hand, the most cost-effective option, 5-year accelerated depreciation, has the smallest impact on recycling.

RPA considered some of the long-run shifts in industrial practices that the incentives would encourage. By comparing the 1- and lo-year cumulative effects, it can be seen how short-run (first year) analyses can underestimate the long-run (lo-year) impacts of such policies.

Table 56 shows OTA'S calculations of the impact of each of the five options on the amount of solid waste to be disposed of, based on the ratio of RPA's estimates of additional recycling to EPA's projections of solid waste disposal. In 1975, the programs would have reduced the solid waste to be disposed of by around 1 percent, increasing to around 2 percent in 1980, and to 3 percent in 1985. The most effective policy in reducing waste disposal is a subsidy of 30 percent of the purchase price paid to users of recycled materials (4.7-percent reduction in waste disposed of in 1985). (See table 56.)

The RPA study shows that user subsidies would reduce the total burden of solid waste

Table 55.— Effectiveness of Various Subsidies to Industrial Users of Materials Recovered From MSW

Policy option	Incremental waste recycling: 1975 (million tons)	1975 (percent increase)	10-year total (1976-86) (million tons)	10-year total (1976-86) (percent increase)	10-year cost -to Federal Government (billion dollars)	10-year cost-effectiveness ($/ton)
30 percent of purchase price	1.7	19	51	48	1.38	2700
$6 per ton of output.	1 2	13	32	30	0.84	2610
25-percent investment tax credit	1.1	13	32	30	0.35	1084
5-year accelerated depreciation.	0.6	6	16	15	0.10	658
75-percent tax credit on interest cost.	1.3	14	37	35	0.81	21.90

SOURCE RPA (13)

Table 56.— Effectiveness of User Subsidies in Reducing the Amount of Solid Waste to be Disposed of

Policy	Percent reduction in solid waste disposed of • 1975	1980	1985
30 percent of purchase price	1.3	3.1	4.7
$6 per ton of output	0.9	2.0	2.9
25-percent Investment tax credit	0.9	2.0	2.9
5-year accelerated" depreciation	0.4	1.0	1,5
75-percent tax credit on interest cost.	1.0	2.3	*3.4*

" Based on net solid waste disposal without subsidy of 128, 156, and 166 million tons per year in 1975, 1980, and 1985(14) and on Incremental recycling estimates from RPA(I 5)

to be disposed of by only 1.5 to 4.7 percent after 10 years. Such subsidies would be more successful in inducing additional recycling of materials from postconsumer wastes since they would cause a 15-to 48-percent increase over the recycling level projected in the absence of subsidies. Administering a subsidy program, to ensure that participants use subsidized capital equipment for the intended purpose or that subsidized materials are in fact recovered from postconsumer wastes, might be a significant problem.

The Severance Tax

DESCRIPTION AND RATIONALE

The severance tax is a tax on virgin materials levied at the point of extraction, mining, or harvest in proportion to the physical amount or economic value produced. Severance taxes have historically been imposed by States to generate revenues or to pay for environmental programs or land restoration. They have typically been levied as a percentage of net income or gross dollar sales, or based on a physical measure of production such as weight or volume. Table 57 shows typical State severance tax levies.

The severance tax can be viewed as a mechanism to offset the cost advantages other policies extend to virgin materials. These include tax preferences (percentage depletion, capital gains on timber income) and indirect subsidies (royalty-free use of public lands for minerals and timber, the inland waterway system, R&D funding, mapping and exploration programs). Programs that give virgin materials a cost advantage do so to accomplish social and political goals or as a spillover from other program objectives. Thus, the severance tax is an alternative to

Table 57.—Typical State Severance Taxes

State	Tax basis
Arkansas	15C per ton of bauxite mined
Idaho	2 percent of value of ores mined
Kentucky	4 percent of value of coal mined
Minnesota,	15 percent of value of taconites mined
Minnesota. .	.....15.5 percent of value of iron ore mined
Montana ., .	30 percent of market value of coal mined

SOURCE (16)

the modification or elimination of such programs.

Another rationale for imposing this tax is to induce long-run resource conservation. It could be designed to correct resource prices for the bias against future generations that results when current decisionmakers discount the future.(17) Taxes on net income are more desirable if resource conservation is the goal, since severance taxes levied on gross sales or on the physical amount extracted encourage the waste of low-grade deposits when they are co-mingled with high-grade ones.

EFFECTIVENESS OF THE SEVERANCE TAX

Under the severance tax, recycling would be stimulated in response to higher relative prices of virgin materials. Unfortunately, no studies have been made of the impacts of a severance tax on the production of virgin materials or on recycling. Since such an analysis was not performed by OTA, no quantitative judgment can be made on its short-or long-run impacts. Clearly, a key determining factor would be the level of the tax relative to total production costs. If the severance tax were set at a few percent of production costs, it might have recycling impacts roughly equivalent to those of repeal of the percentage depletion allowance, which would also increase costs by a few percent (see below).

DISCUSSION OF THE SEVERANCE TAX

The severance tax would be easier to administer than either the product charge or user incentives because first, the number of primary materials producers is considerably smaller than the. number of users: second, since the tax would be applied to virgin material producers there would not be a problem in distinguishing among virgin materials and various kinds of scrap materials; third, there would be no need to be concerned with an exemption for recycled materials; and fourth, firms already report the production and/or sales information required to administer the tax.

The severance tax would apply to all materials, not only to those destined for MSW. For paper and glass, this difference is not great, since about two-thirds of their production becomes MSW. (See chapter 2.) However, only one-fourth of aluminum, one-eighth of ferrous metal, and one-twentieth of other nonferrous metals produced are used in products that become MSW. Thus, this tax would help recycled materials compete with all virgin materials, not just those destined for MSW. On the other hand, if recycling from MSW is the only objective of this tax, the cost to the virgin materials industries could be excessive. Furthermore, unless the severance tax were also applied to imports, a cost advantage would be given to foreign producers of virgin ores and primary metals.

Percentage Depletion Allowance [Modification or Repeal)

DESCRIPTION AND RATIONALE

Existing law allows for deducting various percentages of gross income from mining specified minerals from the income before taxes each year. The effect of this special provision of the tax code is to reduce the tax cost of producing virgin hardrock minerals compared with what it would be if producers had to adjust taxable income on some less favorable basis. The percentage depletion allowance provision has been the subject of a long and sometimes bitter debate. (Its history can be reviewed in a number of sources (16-24).) Supporters of the percentage depletion allowance argue that it is a necessary subsidy to the domestic minerals industries, especially in the face of competition from im-

ported materials. Opponents argue that it is inefficient, because it stimulates overuse of scarce resources and exacerbates some associated environmental problems, and that it is inequitable because competing industries, especially the secondary materials industries, do not receive an equivalent subsidy. It is beyond the scope of this analysis to attempt to resolve these arguments.

From the perspective of resource recovery, recycling, and reduced waste disposal, the key question is whether the economic advantage that percentage depletion gives virgin materials over secondary materials is sufficient to be a major barrier to increasing recycling and reducing waste. Such economic advantage could take the form of lower relative prices for virgin materials than would otherwise be the case. Virgin materials could receive a further advantage if the percentage depletion provision encourages vertical integration of industries from extraction through material fabrication. This would create a barrier to free competition between primary and secondary materials if vertically integrated firms were to set artificially low transfer prices for their own virgin raw materials even though scrap material prices might be lower than virgin-based raw material prices on the open market.

EFFECTIVENESS OF REPEAL OF PERCENTAGE DEPLETION

Since percentage depletion gives an advantage to virgin materials, it is of interest to know whether its modification or repeal would stimulate significant resource recovery, recycling, and waste reduction.

Two major studies, one for EPA by the Environmental Law Institute (ELI)(16) and one for the Bureau of Mines by the JACA Corporation, have recently examined the impact of Federal taxes on the competition between virgin materials and the kinds of secondary materials that are recoverable from MSW.

Both studies estimated the impact of percentage depletion on the cost of producing virgin materials. Table 58 summarizes the results of these analyses. Percentage depletion was found to reduce the cost of producing aluminum by about 1 percent and of steel by about 2 percent. However, the repeal of the depletion allowance would not necessarily lead to price rises equivalent to these percentages. Firms might not be able to pass through all increased costs due to market resistance and to competition from imports. Thus, price increases of less than 1 percent for aluminum and 2 percent for steel would be expected.

Table 58.—impact of the Percentage Depletion Allowance on the Costs of Production of Primary Metals

Material	Year	cost reduction • (percent)	Source
Aluminum ingot.	1973	0.6	JACA (18)
	1974	0.8	JACA (18)
	1975	0.7	JACA (18)
Aluminum.	1973-75	2.2 (maximum)	ELI (16)
Pig iron. ...	1973	1,7	JACA (18)
	1974	2.1	JACA (18)
	1975	2.1	JACA (18)
Steel	1973-75	3.0 (maximum)	ELI (16)
Steel	1973-75	2.0 (likely)	ELI (16)

“ For JACA cost reduction is lax savings as a percent of market price for alumium and of transfer price for pig iron For ELI cost reduction is the per cent shift in industry out put at any price i e the shift in the supply curve

Anderson and Spiegelman of ELI estimated the effects of the repeal of the percentage depletion allowance on the recycling of waste materials due only to the shift in relative prices of primary and secondary materials. They estimated short-run increases in recycling from all sources of only 0.42 percent for obsolete steel scrap and 1.7 percent for old scrap aluminum. In the unlikely event that all of the short-run increases in recycling would be from materials in MSW, percentage increases in recycling from MSW would be somewhat greater than the short-run estimates. They point out that the long-run investment related impacts of repeaI of percentage depletion on materials recycling may be larger than these estimates, and estimated a

6.4-percent increase in recycling of obsolete steel scrap in the long run.

None of the studies reviewed by OTA examined whether percentage depletion has stimulated vertical integration in the materials industries or whether such integration is a significant barrier to recycling. Further analysis of this topic would be desirable.

DISCUSSION OF REPEAL OF PERCENTAGE DEPLETION

The ultimate impact of repeal of the percentage depletion allowance on materials recycling and on reduction of MSW is still uncertain. The ELI and JACA studies suggest that the direct effect of cost and price changes on recycling would be small. However, further analysis of this action would be necessary before predictions could be made with confidence. The impact of percentage depletion on the structure of the materials industries and thus on the nature of the competition between virgin and recycled materials should be investigated. Careful consideration would also need to be given to the impact of repeal of the percentage depletion allowance on costs, profits, performance, employment, and foreign competition in the affected domestic metals industries such as steel, aluminum, and copper. Issues of effectiveness aside, the percentage depletion allowance does appear to give an inequitable advantage to primary materials producers.

Capital Gains Treatment of Income From Standing Timber

DESCRIPTION AND RATIONALE

Existing law allows for taxing of income from the sale of standing timber at rates appropriate to long-term capital gains. These are lower than rates for ordinary income. This provision of the tax code is said to reduce the costs and therefore the price of virgin paper and wood products. It also has the effect of stimulating greater investment in timber production, compared with what it might be without this advantage.

The history and operation of the special tax treatment of timber income along with analyses of arguments in support and in opposition, are presented in an extensive review article by Sunley.(25) Both Sunley and Anderson and Spiegelman(16) note that preferential tax treatment for timber income is not based on economic theory, but on a long history of attempts to provide special tax treatment to various industry sectors, and on a series of compromises with those who have tried to eliminate such treatment.

EFFECTIVENESS OF MODIFICATION OF CAPITAL GAINS TREATMENT OF STANDING TIMBER INCOME

From the point of view of waste generation and materials recycling, the question of whether capital gains treatment of timber income has stimulated overproduction of timber or inhibited recycling of wastepaper should be raised. In a recent analysis, Anderson and Spiegelman estimated that woodpulp market prices are reduced by a maximum of 4.2 percent by the capital gains provision, but that the actual value may lie closer to 1.0 percent than to 4.2 percent. Using several economic models, they estimated that the capital gains treatment of timber income depresses wastepaper recycling by between 0.04 percent and 1.5 percent. A repeal of the tax provision would increase recycling by the same percentages. Accordingly, there would be a short-run increase in recycling of 0.04 percent that would further increase over a longer period of time to 1.5 percent as new plant investment decisions were made. These results suggest that repeal of the capital gains treatment of timber income would be ineffective in increasing postconsumer wastepaper recycling.

Regardless of its effects on the level of recycling, however, the current treatment for tax purposes of income from standing timber gives an advantage to producers of paper from virgin wood not enjoyed by recyclers. Equity considerations would call for removal of this inequity.

Findings on Economic Policy Options

This chapter has been concerned with the potential effectiveness five economic policies would have in stimulating recycling and reducing the rate of MSW disposal. By drawing on previously published literature, it has been possible to present preliminary and partial data for some impacts of certain policies. These findings are summarized in table 59. The entries in the table represent generalizations from the more detailed information presented in the chapter. No entries are shown for the severance tax. However, if it were limited to rates similar to those in current State programs, its effects would probably be on the order of only a few percent.

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 appear 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, and the administrative problems of the exemption may be so great as to render the charge concept unworkable. The recycling allowance faces similar administrative problems.

Table 59 suggests that repeal of the percentage depletion allowance on hardrock minerals or repeal of the capital gains treatment of timber income would increase recycling very little. Furthermore, these actions are not expected to significantly reduce the generation of waste, although quantitative estimates of this impact have not been made. Nevertheless, these tax provisions do treat secondary materials unfairly in their competition with primary materials.

Table 59.—Generalized Summary of a Preliminary Assessment of the Impacts of Selected Economic Policies on Waste Disposal and Recycling

Policy	Decrease in disposal of MSW (percent)	Increase in materials recycling from MSW (percent)
Product charge	7 to 10+	100 or more
Recycling allowance*	1.3 to 4.7	19 to 48
Severance tax	?	7
Repeal of percentage depletion allowance	?	0.4 to 1.7
Repeal of capital gains treatment of standing timber income	?	0.04 to 0.7

"Financial Incentives to users of recycled materials

However, indirect effects on recycling may be larger than indicated by table 59. Additional analyses are needed to explore more fully the implications of these provisions of the tax code for the nature of the competition between primary and secondary materials and for the competition between domestic and foreign producers.

OTA has not systematically assessed the side effects of the five policies examined in such important areas as prices, profits, Government revenues, administrative costs, employment, foreign competition, or long-run materials and energy conservation. Each of these need to be analyzed indepth to get a complete picture of the outcomes of such policies.

Each of' the five options considered would be supportive of or compatible with resource recovery programs and beverage container deposit legislation, because each would strengthen the market for recycled materials.

Other economic policy options might be considered for adjusting the short- or long-run competition among primary and secondary materials. The five discussed here, while the most widely considered, do not exhaust the possibilities outlined in table 52.

48-786 0 - 79 - 12

Only a small number of studies of the response of materials flows to economic policies have been published. Further research and analysis are needed to help clarify this important area of resources policy. Studies are needed on 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.

Finally, this chapter has examined a number of Federal policy options, each of which would have only a limited effect on resource recovery and recycling. Adopting several such policies together might serve to create a climate in which activities would grow beyond those predicted by the economic models.

References

1. Committee Findings and Staff Papers on National Beverage Container Deposits. Second Report of the Resource Conservation Committee, January 1978.
2. Presidential Proclamation, Administration of Jimmy Carter, 1977. Nonfuel Minerals Policy: Announcement of Cabinet-Level Interagency Study, Dec. 12, 1977.
3. Public Law 94-568 (90 Stat. 2697) amending the Internal Revenue Code of 1954.
4. Personal communication, Seymour Fiekowsky, U.S. Department of the Treasury.
5. Gander, James P., "The Relationship of Technological Change and the Demand for and Supply of Raw Materials, " Department of Economics, University of Utah, report to the National Science Foundation under grant number RDA 74-20198 A04, 1976.
6. Greenberg, Edward, Christopher T. Hill, and David J. Newburger, "Regulation, Market Prices, and Process Innovation: The Case of the Ammonia Industry, " Westview Press, Boulder, Colo., 1979.
7. "Rationale for National Solid Waste Disposal Charge Legislation," Resource Conservation Committee Staff Background Paper No. 8, Apr. 17, 1978.
8. "Solid Waste Disposal Charge Design Issues," Resource Conservation Committee Staff Background Paper No. 9, Apr. 17, 1978.
9. Miedema, A. K., T. H. Bingham, and J. Daber, "Preliminary Analysis of a Product Charge on Major Components of Post-Consumer Solid Wastes," report by Research Triangle Institute for EPA, June 7, 1976.
10. Miedema, A. K., et al., "The Case for Virgin Material Charges: A Theoretical and Empirical Evaluation in the Paper Industry, " report by Research Triangle Institute for EPA, January 1976.
11. Environmental Protection Agency, Fourth Report to Congress on Resource Recovery and Waste Reduction, EPA Report SW-600, 1977, pp. 88-99.
12. Franklin Associates, Ltd. and International Research and Technology Corporation, Solid Waste Management and the paper Industry, prepared for the Solid Waste Council of the Paper Industry, March 1979, p. v-3.
13. Research Planning Associates, "A Study of Federal Subsidies to Stimulate Resource Recovery, " report for EPA, 1974, pp. 17-46. Available from NTIS as PB-239-736.
14. Environmental Protection Agency, op. cit., p. 20.
15. Resource Planning Associates, op. cit., p. 95a.
16. Anderson, Robert C. and Richard D. Spiegelman, "Impact of the Federal Tax Code on Resource Recovery," report to EPA by the Environmental Law Institute, December 1976. Report EPA-600/5-76-009. Available from NTIS as PB-264 886.
17. Page, R. Talbot, Conservation and Economic Efficiency, Johns Hopkins Univ. Press, Baltimore, Md., 1977.
18. Commins, James A., et al., "Barriers to the Use of Secondary Metals, " report to the U.S. Bureau of Mines by JACA Corp., Fort Washington, Pa., August 1977.
19. Anderson, R. C., A. S. Miller, and R. D. Spiegelman, "U.S. Federal Tax Policy: The Evaluation of Percentage Depletion for Minerals, " Resources Policy, 3, 165-178, September 1977.
20. Tannenwald, Robert, "Analysis and Evaluation of Arguments For and Against Percentage Depletion, " Congressional Research Service report 78-68E, Mar. 11, 1978.
21. "Copper, Percentage Depletion and The Public Interest," prepared by AMAX Inc. and 10 other copper companies, undated, mimeo (1978).
22. Letter to W. M. Blumenthal, Secretary of the Treasury, from J. Allen Overton, Jr., President, American Mining Congress,

Aug. 23, 1977. Publically available from AMC.
23. Material Needs and the Environment *Today* and Tomorrow. Final Report of the National Commission on Materials Policy, June 1973, pp. 4D-14 to 4d-17.
24. Government and the Nation's Resources. Report of the National Commission on Supplies and Shortages, December 1976, pp. 160-166.
25. Sunley, Emil M., Jr., "The Federal Tax Subsidy of the Timber Industry," The *Economics of* Federal Subsidy Programs, U.S. Congress Joint Economic Committee, 1972, pp. 317-342.