

# Waste reduction

## Issues and policies

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**This paper reviews the major problems that confronted the Committee set up by the Solid Waste Management Board of the state of California to prepare a background report and recommend alternative methods for reducing solid waste generation. The results of their analysis are presented, together with discussion of the conclusions reached.**

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An ever-increasing problem faced by urban areas in our so-called 'advanced societies' lies in disposing of the residuals from production and consumption processes. In California, for example, nearly 20 million tons of municipal solid wastes are generated each year, and this figure is currently expected to grow at an annual rate of 1-2%.<sup>1</sup> The average resident in a metropolitan area generates between 2-3 lb of household refuse per day, adding to the 2½-3 lb of commercial refuse produced per capita.<sup>2</sup> These figures do not include the vast quantities of agricultural, industrial, and other wastes.

It is becoming increasingly difficult and costly<sup>3</sup> to dispose of such wastes without causing damage to the environment. Suitable landfill sites close to urban areas are scarce; technological processes (such as incineration) which can reduce, although not normally eliminate, the need for landfill space require major capital investments and are expensive to operate; and growing public opposition poses problems for the siting of any solid waste facility. Furthermore, the feeling is increasing that we cannot afford simply to discard our wastes, since they contain potentially valuable resources.

There are three basic approaches to dealing with the solid waste problem. The first is to continue the traditional practice of attempting to assimilate the wastes into the environment without causing unacceptable damage. The second is to seek the recovery of as much energy and materials as possible from the waste stream. The third is to try to reduce the rate at which the wastes are generated in the first place. At present, the first approach is the most widely used, the second is gaining increased support, but attention is only just beginning to focus on the third. This approach, commonly known as 'waste reduction',<sup>4</sup> could have a major impact on the solid waste problem; however, it also has implications of a much wider significance, as will become evident from this paper.

In California, the Nejedly, Z'Berg, Dills Solid Waste Management and Resource Recovery Act of 1972 required the newly established State Solid Waste Management Board to investigate 'changes in current product characteristics, and production and packaging practices, which would reduce the amount of solid waste generated at its source' (Section 66785(b)2). In January 1975 the Board established a Source Reduction and Packaging Policy Committee with the task of preparing a background report and recommending alternative methods for reducing solid waste generation.<sup>5</sup> The Committee, whose findings were communicated to the Board in March 1976, included representatives from civic and environmental

<sup>1</sup> California State Solid Waste Management Board, *Resource Recovery Program*, Draft, 1975.

<sup>2</sup> California State Solid Waste Management Board, *Solid Waste Generation Factors in California*, Bulletin no. 2, Technical Information Series, 1974.

<sup>3</sup> According to EPA's Office of Solid Waste Management Programs, local government expenditure on solid waste management is currently of the order of \$2-4 billion per year.

<sup>4</sup> The approach was formerly known as 'source reduction'.

<sup>5</sup> The present author was retained by the Board as a Consultant to assist the Committee in the analysis of waste reduction methods and the preparation of its report.

groups, government agencies, and industries interested in product packaging.

## Defining waste reduction

The first problem confronting the Committee was that of defining their area of concern. In the US Environmental Protection Agency's Third Report to Congress on Resource Recovery and Waste Reduction,<sup>6</sup> waste reduction is defined as the 'prevention of waste at its source, either by redesigning products or by otherwise changing societal patterns of consumption or waste generation'. However, there has been some confusion over the distinction between waste reduction and resource recovery, both of which are intended to conserve natural resources and reduce the flow of materials requiring disposal. If a refillable bottle is returned to a retailer for a deposit and is subsequently reused, this has generally been considered to be waste reduction; however, if a householder separates out newspapers, glass, or metals from the rest of the garbage and makes them available for recycling (either voluntarily or for payment), this has generally been considered to be resource recovery.

The distinction appears to hinge on the definition of 'waste' or, more precisely, the point at which an item is said to enter the waste stream. The Committee decided that for the purpose of their report, the waste stream would by definition include all items that no longer serve their originally intended purpose. Thus a refillable container, while it continued to be reused, would not be considered a waste, while a non-refillable container would be (even if it is recycled into the manufacture of new containers). It was noted that the latter has value solely because of its content of materials, while the former also has value as a product (although even refillable containers are ultimately discarded, at which time they become waste).<sup>7</sup>

The importance of the distinction should perhaps not be exaggerated, since both waste reduction and resource recovery are simply means to an end. It can be argued that, in comparing policy options, the overriding consideration should be the extent to which benefits are gained (ie objectives are met) at an acceptable level of costs, rather than the way in which the policies happen to be categorised. Studies by the Environmental Protection Agency (EPA) have indicated that a balanced approach using more than one option is likely to be the wisest course to take.<sup>8</sup>

## Objectives of waste reduction

The next problem was to define the objectives of waste reduction. It soon became apparent that a number of different objectives were of concern, including the reduction of solid waste management costs, the reduction of litter, the conservation of natural resources, and the reduction of adverse environmental effects associated with the flow of energy and materials through the economic system.

### *Solid waste management costs*

The primary impetus for waste reduction has come from those concerned with the ever-increasing solid waste problem, their main objective being to reduce the costs (financial, environmental, social, political, etc.) of handling and disposal. A reduction in the weight of

<sup>6</sup> Office of Solid Waste Management Programs, *Third Report to Congress – Resource Recovery and Waste Reduction*, Environmental Protection Publication SW-161, US Environmental Protection Agency, 1975.

<sup>7</sup> The discussion concerning the definition of waste reduction was based to a large extent on a memorandum to the Source Reduction and Packaging Committee by Thomas D. Clark, 1975.

<sup>8</sup> N. Humber, 'Waste Reduction and Resource Recovery – There's Room For Both', *Waste Age*, 1975.

the waste stream would be one way of meeting the objective; however, depending on the handling/disposal methods used, the costs are also influenced by the volume and nature of the wastes (eg, their biodegradability, toxicity, combustion characteristics, etc.). The Committee realised that a proposed policy could have a desirable effect on one parameter, but an undesirable effect on another; for example, the weight of the stream could be reduced by substituting containers made of polyvinyl chloride for those made of glass, but if the wastes are disposed of by combustion, the substitution could aggravate air pollution (due to the emission of hydrogen chloride).

### *Litter*

It was recognised that many of the policy options proposed for waste reduction would also reduce litter; indeed, the legislation requiring mandatory refunds on beverage containers, already enacted in some states (eg Oregon and Vermont), was introduced with litter reduction as its prime objective. However, since the Solid Waste Management Board has so far chosen to consider the litter problem separately from the more general issue of waste reduction,<sup>9</sup> the Committee placed it low on the list of priorities.

### *Conservation of natural resources*

To the extent that waste reduction measures would reduce the flow of energy and materials through the economic system, they would reduce the need to extract raw materials from the environment and would therefore conserve natural resources. However, the Committee found it difficult to define a satisfactory measure of attainment because priorities in conservation are not well established; most people would consider that it is more important to conserve some resources than others (thus the reduction in weight of raw materials is not by itself a satisfactory measure), but there is no general agreement on the relative values (from a conservation viewpoint) of different resources.

It was pointed out that in establishing priorities, policy makers would almost certainly wish to take into account the relationship between projected resource needs and projected availability, making reasonable assumptions about the likelihood and extent of future discoveries, technological developments, changing economic and political constraints, and the availability of substitutes. A high priority is likely to be assigned to energy resources, savings in which can readily be measured in terms of heat values.

### *Reduction of adverse environmental impacts*

Apart from directly reducing the environmental impacts associated with the handling and disposal of solid wastes, waste reduction measures (to the extent that they would reduce the total energy and materials flow) would also indirectly reduce the impacts at other stages in the economic system, from extraction through processing and distribution to 'consumption' (perhaps better described as 'use'). Once again, the Committee found it difficult to measure attainment of this objective; by itself, the weight of residuals generated is not strictly suitable, since other factors such as the nature of the residuals and the method of their disposal are crucial in determining the environmental impact.

<sup>9</sup> A separate committee has reported on the subject of litter management in California. See California State Solid Waste Management Board, *Report on Litter Management in California: Conclusions and Recommendations*, 1974.

### *Conflicts between objectives*

Just as conflicts might arise in meeting a single objective, depending on how its attainment is measured, it was apparent that there might also be conflicts in meeting objectives. For example, a policy designed to increase product durability and thus reduce the generation of solid waste might result in the use of 'exotic' materials (such as metal alloys) made from resources that are considered more important to conserve than those used in less durable products.

Faced with this problem, the Committee did not attempt to reach agreement in advance on a set of weights reflecting the relative merits of achieving the three major objectives.<sup>10</sup> Instead, they called for a value-free analysis of the likely effectiveness of each proposed policy in meeting each of the objectives, together with a review of other impacts, and subsequently compared policies directly on the basis of each individual's subjective judgement. By doing this it was recognised that the Solid Waste Management Board would have the option either of accepting the Committee's recommendations (implying acceptance of their trade-offs) or of reassessing the information about each policy in the light of their own preferences.

## **The costs and benefits of measures for achieving waste reduction**

### *The distribution of impacts*

The Committee recognised that the introduction of measures designed to achieve waste reduction would undoubtedly impose costs on certain segments of society. Apart from the costs to the government of administering these measures, shifts in production patterns (with a possible reduction in total material output) would impose costs on some industries, some employees might lose their jobs, and some consumers would suffer as the result of involuntary changes in their consumption habits and/or the necessity to pay more to maintain existing habits.

At the same time, the measures would be expected to result in benefits for other segments of society (apart from the overall benefits which provide the main reason for the measures' introduction). Thus some industries would gain rather than lose from shifts in production patterns (eg, a shift to refillable bottles would benefit the manufacturers of bottle-washing equipment), some new job opportunities would open up (eg, handling the refillable bottles), and some consumers would gain (eg, those buying goods whose durability is increased).

### *Waste reduction and the standard of living*

An issue which greatly concerned the Committee was whether waste reduction measures would cause a decrease in the standard of living for society as a whole. It was pointed out that by intention, they would certainly decrease the level of material throughput, but whether this would represent a reduction in the standard of living depends on how the latter is measured. If it is measured by the market value of the flow of goods and services through the economy (ie by their contribution to the Gross National Product), then clearly the standard of living would be reduced to the extent that the value of this flow is reduced.

<sup>10</sup> Little attention was paid to the litter problem, for the reason mentioned.

However, it is now well established that market values frequently fail to reflect many of the factors that govern the welfare of society. Costs such as resource depletion and environmental pollution represent as much of a drain on social welfare as any other costs, but they commonly remain external to economic accounting because, under existing property rights, private individuals and firms are not required to take into account the full consequences of their actions. Thus, for example, manufacturers who design their products with 'built-in obsolescence' do not normally have to consider the resulting implications for solid waste handling and disposal; indeed, since they do not have to pay the extra costs involved, it is often in their interest to design short-lived products. If the standard of living were measured in such a way that it reflected the full social costs and benefits of economic activities, a reduced material throughput might be found to give a higher standard of living.

Another, more fundamental reason was given for this. Conventional economic accounting attaches value to provision of the means of consumption rather than to the actual satisfaction of needs which may take place much later and often over an extended period. Thus an increase in the flow of goods and services for consumption is seen as something desirable. However, it has been argued that welfare is more closely related to a stock than to a flow;<sup>11</sup> in other words, it is the capital stock from which satisfactions are derived, rather than the additions to it (production) or the subtraction from it (consumption). If this is true, 'consumption, far from being a desideratum, is a deplorable property of the capital stock which necessitates the equally deplorable activities of production'.<sup>12</sup> On this basis, welfare would be best served by minimising rather than maximising throughput, for a given level of satisfaction of needs. The notion of waste reduction is clearly consistent with this philosophy.

### **Basic approaches to waste reduction**

The Committee reviewed the three basic approaches to waste reduction listed in the EPA's Third Report to Congress. The first is to reduce the quantity of material used per unit of product (in the product itself or in its packaging); for example, a milk container has been designed which uses 31% less paper and 16% less plastic than the traditional package, but still contains a half-pint of milk. The second approach is to increase the average lifetime of durable and semi-durable goods to reduce discards and replacement needs; for example, if longer-lasting radial tyres were fitted on motor vehicles instead of bias or belted bias tyres, there would be a substantial reduction in the quantity of tyres wasted. The third approach is to substitute reusable products for single-use 'disposable' products and to increase the number of times that items are reused; for example, it has been demonstrated that considerable material and energy savings could result from replacing paper plates with reusable dishes.

Implied in the first two approaches is the notion that the products/packaging affected would still serve essentially the same function (ie they would still satisfy the same consumer needs); however, they would do this using less material resources. The same is only partially true of the third approach in that a refillable beverage container, for example, does not perform the same 'convenience' function served by a disposable (although both serve the basic

<sup>11</sup> K.E. Boulding, 'The Economics of the Coming Spaceship Earth', in *Environmental Quality in a Growing Economy* (H. Jarrett, ed., 1966).

<sup>12</sup> K.E. Boulding, 'Income or Welfare', *Review of Economic Studies*, no. 79, 1949/50.

function of containing liquid). The Committee agreed that a fourth approach should be added to the list, namely that of directly reducing the consumption of material goods by persuading people to sacrifice having certain functions satisfied (ie, to moderate their needs).

### **The analysis of waste reduction policies**

A list of proposed policy options was developed by the Committee and the present author, based largely on those mentioned in the existing literature (but also incorporating new ideas). As will be seen below, the policies fall into the three categories of regulations; fiscal incentives; and voluntary efforts.

The analysis attempted, as objectively as possible, to identify the likely effects of each policy option on:

- the solid waste stream;
- materials and energy utilisation/environmental impact;
- government revenues/costs;
- industry;
- employment; and
- consumers.

It was recognised that a given policy option typically has many variations and can have (very) different impacts. For example, it makes a considerable difference to the likely effects of a tax on packaging by weight whether or not an exemption is granted for the use of recycled materials. A policy option may be considered acceptable in one variation, but wholly unacceptable in another. For this reason, the analysis examined a set of general approaches but made reference to at least some of the possible variations under each.

It was clearly impossible to identify and describe all the impacts of each policy option and variation thereof. An attempt was made to describe the impacts most likely to be significant, based whenever possible on the results of existing studies. However, there are few of these, and in the absence of tried government policies it was necessary to base much of the analysis on informed speculation. Each of the options and their possible effects are described selectively below.

#### *Regulations*

Possible regulatory approaches include the use of standards governing the characteristics (eg, disposability, durability, etc.) of certain products, minimum warranty requirements, and restrictions on government purchasing.

In general, the advantages of regulations stem from the directness with which they attack the problem and the reasonably high predictability of their immediate impacts. However, they can be costly to administer and enforce, difficult to write so as to cover all possible situations, and once written tend to be inflexible. The regulatory approaches considered in the analysis are set out below.

*Option 1. Direct regulation of individual products (non-durables).* Designated products (notably packages but possibly also other single-use products such as disposable cutlery, plates, clothing, etc.) would be subject to review by a state agency and would be approved for sale only if they meet pre-specified criteria (based on considerations of solid waste management and environmental protection). Each

product under review would be compared with alternatives performing the same or similar function to encourage minimum consumption of resources and minimum adverse environmental impact. The model on which this regulation might be based is that provided by the Minnesota Packaging Law of 1973, under which the Minnesota Pollution Control Agency has issued regulations<sup>13</sup> for the review of new or revised packages.

If exemptions were granted to existing packages, the effects on the present solid waste stream and on resource utilisation/environmental impact would probably be small, although future adverse impacts might be reduced. On the other hand, if exemption were not granted, the effects on the waste stream could be much more significant, but the costs of administration and the dislocation suffered by industry could be very severe.

*Option 2. Purchasing regulations for state agencies, etc. (non-durables).* State agencies would be prohibited from purchasing designated single-use products and/or products in designated non-returnable containers. Similar purchasing restrictions would govern the use of state funds by other government agencies, contractors, schools, etc. Prohibited items would be designated on the basis that less wasteful alternatives are available to fulfil the same or a similar function at a reasonable cost.

The direct impact of this measure would probably be small; the purpose would be to stimulate markets for reusable products and to serve as an example to others. If successful in this, it could have a significant indirect impact.

*Option 3. Direct regulation of individual products (durables).* Certain products such as household appliances, TV sets, etc., specified by their SIC codes,<sup>14</sup> would be subject to regulations affecting such characteristics as their material content, energy requirements, ease of maintenance/repair, and durability. By a designated future date, manufacturers would have to demonstrate to a state review board that their products were designed to meet the requirements and that there was adequate quality control on mass-produced items. Products that failed to meet the requirements could not be offered for sale in California.

This measure could have a significant effect on the durable goods component of the solid waste stream (currently about 10-15% by weight), though not immediately (depending on the lifetimes of the products affected). It is impossible to predict the effect on resource utilisation/environmental impact; for example, if durability were given the highest priority in the regulations, the quantity of materials used over time would probably decrease (owing to a decrease in the rate of production of goods<sup>15</sup>) but there might be a shift in the *nature* of materials used, possibly to those which are more scarce and/or whose extraction and utilisation involve more adverse environmental impacts. The measure would be costly to administer and is likely to produce an increase in the initial selling price of products, although there might be savings for consumers in the long term due to improved product characteristics.

*Option 4. Minimum warranty requirements (durables).* For designated durable products (specified by SIC code), the state would require the manufacturer to provide a complete and unconditional

<sup>13</sup> Minnesota Pollution Control Agency, *Regulations for Packaging Review*, 1974. A temporary injunction currently prevents the Agency from enforcing these regulations.

<sup>14</sup> The codes are given in the US Department of Commerce Numerical List of Manufactured Products (New, 1972, SIC basis).

<sup>15</sup> Unless consumers react to having longer-lived products by increasing their stock of goods.

warranty (including parts and labour) on some or all parts of each product for a specified minimum period of time.

The effectiveness of this measure would depend on whether it would in practice lead to increased product durability. It may be noted that in the late 1960s many warranties for television, refrigerators, and other durable goods were extended from a 90-day to a one-year coverage as the result of consumer pressure and competition between manufacturers; there is some evidence<sup>16</sup> to suggest that manufacturers have, as a result, improved the design of their products so that fewer repairs would be needed, at least in the first year of operation.

Initial administrative costs are likely to be high as an agency would have to establish warranty terms that are feasible and reasonable for each designated product. Manufacturers' costs would increase, probably leading to higher product prices; however, consumers would face reduced risks when buying products. There might be problems of enforcing warranties, with consumers having to pay costs in time, inconvenience, legal fees, etc., as well as having to overcome any psychological aversion to 'fighting' with a manufacturer or retailer.

*Option 5. Mandatory disclosure of environmental impact (non-durables and durables).* After a specified future date, designated products (including non-durables such as packaging and/or durables such as household appliances) could not be offered for sale in California unless a satisfactory statement of resource utilisation/environmental impact had previously been filed with the State Solid Waste Management Board. The statement would have to include such items as: an assessment of virgin materials use, energy use, water use, industrial solid wastes, post-consumer solid wastes, air pollution emissions, and water pollutant effluents for each stage in the product's life cycle (from the extraction of raw materials through ultimate disposal);<sup>17</sup> the secondary material content of the product; an estimate of its durability under 'reasonable' use conditions; and a list of alternative products serving the same or a similar function. The document or an approved summary thereof would be made available by retailers for public inspection.

This measure would permit consumers to make more informed purchasing decisions. Its effectiveness in attaining waste reduction objectives would depend on whether consumers, as a result, shift their purchasing habits and cause manufacturers to react by changing production methods and specifications, etc. The main cost of the measure would initially fall on manufacturers, who would undoubtedly pass at least some of it on to consumers; there would also be administrative costs associated with reviewing the adequacy of the assessments, etc.

### *Fiscal incentives*

Possible approaches involving fiscal incentives include the use of deposits on reusable products (notably containers), product charges and other forms of taxation, and subsidies to offset the costs of achieving waste reduction. In principle, taxes or subsidies can be set at levels appropriate to correct the divergence between private and social costs and benefits (discussed earlier) and thus promote efficiency in the allocation of resources; however, in practice it is difficult (if not impossible) to determine what these levels should be.

<sup>16</sup> MIT Center for Policy Alternatives, *The Productivity of Servicing Consumer Durable Products*, 1974.

<sup>17</sup> This would be a so-called 'REPA' analysis of the kind reported in R.G. Hunt and W.E. Franklin (Midwest Research Institute), *Resource and Environmental Profile Analysis of Nine Beverage Container Alternatives*, Environmental Protection Publication SW-91c, US Environmental Protection Agency, 1974.

Taxes can be used not only to provide an incentive for waste reduction but also to raise revenue which can be drawn upon to support government activities in waste reduction, resource recovery, and other fields. A major advantage of the tax/subsidy approach is that it permits individuals and firms to reallocate resources in the most efficient manner, albeit under a new set of constraints; thus, for example, the person who greatly values convenience would still be able to discard his refundable beverage container instead of returning it, but at a price (whereas under a regulation, he would probably have no choice). On the other hand, incentive approaches have the disadvantage that because of their indirect nature, they tend to be more unpredictable in their outcome than regulations, and more difficult to design so as to ensure the achievement of their objective; furthermore, they too can be costly to administer (although not usually as much as regulations, and costs can be kept to a minimum by the use of existing collection/disbursement channels). Fiscal incentives approaches considered in the analysis are set out below.

<sup>18</sup> See, for example: Applied Decision Systems, *Study of the Effectiveness and Impact of the Oregon Minimum Deposit Law*, Final Report, Presented to Oregon Legislative Fiscal Officer and Department of Transportation, Oregon Division of Highways, 1974; T.H. Bingham and P.F. Mulligan (Research Triangle Institute), *The Beverage Container Problem: Analysis and Recommendations*, US Environmental Protection Agency, 1972; T.H. Bingham et al. (Research Triangle Institute), *An Evaluation of the Effectiveness and Costs of Regulatory and Fiscal Policy Instruments on Product Packaging*, Environmental Protection Publication SW-74c, US Environmental Protection Agency, 1974; G.M. Gudger and J.C. Bailes, *The Economic Impact of Oregon's 'Bottle Bill'*, 1974; California Legislative Analyst, *The Economic Impact of a Proposed Mandatory Deposit on Beer and Soft Drink Containers in California*, 1975; E.F. Lowry, T.W. Fenner and R.M. Lowry, *Disposing of Non-Returnables - A Guide to Minimum Deposit Legislation*, Stanford Environmental Law Society, 1975; A.A. Marino and L.A. Burch, *The Oregon Bottle Bill in California*, Preliminary Draft, California State Solid Waste Management Board, 1975; Office of Solid Waste Management Programs, *Questions and Answers on Returnable Beverage Containers for Beer and Soft Drinks*, US Environmental Protection Agency, 1975; Senate Task Force on Critical Problems, *No Deposit, No Return ... A Report on Beverage Containers*, New York State Senate, 1975; US Department of Commerce, Domestic and International Business Administration, Bureau of Domestic Commerce, *The Impacts of National Beverage Container Legislation*, Staff Study, 1975; G.L. Wagner, *Report to the US Department of Commerce on the Oregon 'Bottle Bill'*, 1973; D. Waggoner, *Oregon's Bottle Bill - Two Years Later*, 1974.

<sup>19</sup> There is some dispute as to the precise trippage rate necessary to ensure that a returnable system would be ecologically sound. One study (Hunt and Franklin, *op. cit.*) suggests that the number may be as low as 2, while representatives of the glass container industry on the Committee claimed that 6 or 7 is the appropriate number. Available evidence suggests that trippage rates for returnable bottles in practice are generally higher than 7.

<sup>20</sup> Currently about 6% of the municipal solid waste stream (average).

*Option 6. Mandatory refunds on beverage containers.* All beer and soft drink containers would be required to have a specified refund value, payable on receipt of the containers by all distributors. Certified beverage containers, which are reusable by more than one manufacturer, might carry a smaller refund value. The model for this measure would be Oregon's Minimum Deposit Law, which became effective on 1 October 1972.

Of all the measures considered in the analysis, this has been the most studied.<sup>18</sup> However, the likely impacts remain uncertain, since they would depend on a number of unknown factors, ie, the extent to which there would be a shift in the mix of container types; the extent to which containers would be returned for their refund value and subsequently reused (ie the trippage rate); and the extent to which total beverage sales would be affected. For example, assuming that there is a significant shift to the use of returnables, that the trippage rate is sufficiently high,<sup>19</sup> and that there is some reduction in total beverage sales, there would be a significant reduction in the beverage container portion of the waste stream,<sup>20</sup> significant savings in resources, and reduced environmental impact. On the other hand, if the trippage rate is low (eg if the heavier refillable containers are discarded regardless of their refund value) there might be an increase in the waste stream as well as increased resource utilisation and greater environmental impact.

The measure could have a significant impact on industry due to a possible reduction in total beverage sales, a likely reduction in the sales of metal containers, a possible reduction in the sales of glass containers (depending on the trippage rate), and the need for investment in storage, transportation, washing, refilling, etc. The net effect on employment is unknown; although there would be a decrease in the number of skilled jobs in the metal and glass container industries, this would be partially or wholly offset by an increase in the number of lower-paid, unskilled jobs in the beverage production, distribution, and retailing industries, as well as common carrier trucking, due to the need for additional handling of the refillable containers.

*Option 7. Disposal tax by weight (non-durables; possibly durables also).* A tax would be levied at the manufacturing level on the weight

of designated non-durable products sold in the state, such as packaging, single-use disposable goods, etc.; it might also apply to durable goods. The level of the tax could reflect the average costs associated with the collection and disposal of solid wastes (as determined by the Board); alternatively the tax rate could vary according to a product's 'disposability', or it could be set irrespective of collection/disposal costs. A tax reduction or exemption might be provided for the use of returnables and/or recycled materials.

The key factors influencing the likely effectiveness of this measure are the level at which the tax would be set and whether or not an allowance/exemption would be provided for the use of returnables and/or recycled materials. If the tax were set at \$26/ton (corresponding to average solid waste collection/disposal costs across the nation), and no allowance/exemption were given, the results of a published study<sup>21</sup> suggest that the measure would have only a slight effect on the solid waste stream, on resource utilisation, and on environmental impact. Since a tax by weight would almost certainly cause a shift from the use of heavy products to that of light products serving the same or a similar function (eg from glass bottles to plastic bottles or aluminium cans), the impacts could be adverse. If an exemption for returnables/recycled materials were given, the study predicts a significant reduction in raw materials consumption, although the other impacts would remain small.

*Option 8. Tax on containers.* A tax would be levied on each rigid or semi-rigid container (including a semi-rigid toothpaste tube but not a polyethylene bag). The tax would be charged to the container manufacturers, and a reduction or exemption could be given for containers designed for reuse.

There is some evidence<sup>22</sup> that a tax of 1 or 2 cents per container could be significantly effective in attaining the objectives of waste reduction (for example, reducing the packaging component of the waste stream by as much as 11% and the consumption of raw materials by as much as 10%). The tax would have most impact on low-cost containers (such as those made of paper) and might produce a shift in packaging types (eg, from rigid to flexible containers).

*Option 9. Disposal tax based partly on weight, partly on units (non-durables).* A tax would be levied on designated products, notably those comprising the major portion of the waste stream (including consumer rigid and flexible packaging and non-packaging paper other than construction grades, but excluding consumer durables). For products other than rigid containers, the tax would be based on weight, while rigid containers would be charged at a fixed rate per unit. The tax would be levied at the bulk production level. This approach, first discussed in detail by Smith,<sup>23</sup> was incorporated in the proposed Solid Waste Utilisation Act, considered in the 94th US Congress. The Act provided for an initial tax level of 1.3¢/lb (\$26/ton) or 0.5¢ per rigid container, a gradual phasing in of the tax over a 10-year period to aid adjustment, and a temporary subsidy for the use of recycled materials, to be phased out over the 10-year period as the tax is phased in.

The likely effectiveness of this measure can only be inferred from the existing study<sup>24</sup> which considers the weight-based and unit-based taxes separately. It would seem that, depending primarily on the tax rate adopted, the measure could significantly reduce the solid waste

<sup>21</sup> Bingham et al., 1974, *op. cit.*

<sup>22</sup> *Ibid.*

<sup>23</sup> F.L. Smith Jr, 'National Solid Waste Disposal Charges: Illustrative Design II', Office of Solid Waste Management Programs, US Environmental Protection Agency, 1975.

<sup>24</sup> Bingham et al., 1974, *op. cit.*

stream (particularly the packaging component), while also reducing resource utilisation/environmental impact.

*Option 10. Value-based tax (non-durables).* A tax would be levied on the value of designated non-durable products such as packaging, single-use disposable goods, etc.<sup>25</sup> The tax would be imposed on the manufacturers of the products covered. A reduction or exemption could possibly be provided for the use of secondary materials and/or for products that are designed for reuse.

The tax would be expected to cause shifts from more expensive to less expensive forms of the products where this is functionally possible, and/or reductions in the overall consumption of these products. Most affected would be consumer goods of whose value a large proportion is taxable (eg cosmetics in expensive packages); however, the high value might in some cases be due to extensive labour input and might not be indicative of a product's solid waste potential or of the resource utilisation/environmental impact associated with it. Unless the tax were very high, it was thought unlikely to be very effective.

*Option 11. Variable waste collection/disposal fee.* Instead of a flat-rate fee for collection/disposal of post-consumer solid wastes (as is common for municipal collections at the present time), a variable fee based on volume (ie the number of garbage containers) could be charged. Ideally, each collection would be separately metered; alternatively, householders could be charged a fee according to the number of containers that they wish to have collected regularly.<sup>26</sup> Specified source-separated materials, put out for separate collection, could be exempted. The fee could be set at a level just sufficient to cover costs, or at a higher level to act as a greater disincentive to waste generation. The rate could increase with the waste collected.

If the fee were low, this would probably have little effect; if the fee were high, people might avoid putting waste out for collection by delivering it personally to the disposal site or by causing increased litter and other forms of uncontrolled disposal, with their associated environmental impact. If the fee were based on volume, increased compaction of the waste by the householder (including the use of energy-consuming home compactors) might result, giving a reduction in volume but not in weight.

*Option 12. Subsidy to offset capital costs of converting from one-way to reusable products.* Tax relief or another form of subsidy (eg low interest and/or guaranteed loans) would be provided to manufacturers, distributors, retailers and associated industries to offset the capital costs involved in converting from the production/handling of one-way products (eg beverage containers) to that of reusable products.

This measure was thought unlikely to cause any significant change by itself; however, in combination with one or more other measures it might produce a more rapid and extensive transition to a system employing reusable products, with waste reduction benefits.

#### *Voluntary efforts*

The encouragement and support of voluntary efforts can involve R & D, the provision of technical information, publicity, etc. These activities are not without their costs and their impact is uncertain;

<sup>25</sup> This tax would not be proposed for durable goods since it would tend to encourage the production of less expensive products, which would probably be less durable.

<sup>26</sup> This is the method of charging currently used by some private contractors.

however, they tend to be more widely acceptable than other approaches because they interfere the least with existing freedoms and pose little or no direct threat to established interests.

A group of possible measures to encourage voluntary efforts were considered in the analysis under a single heading.

*Option 13. Encouragement of voluntary waste reduction efforts.* The state government would conduct research on methods of waste reduction, provide education, technical advice, etc. on waste reduction to industry and consumers (pointing out how it can be in their own interest to reduce waste), and persuade companies and individuals to voluntarily reduce waste.

The effectiveness of these measures would depend on their precise nature and is therefore impossible to predict. At the national level, the Environmental Protection Agency already has a small research programme in waste reduction and is disseminating information on the subject; there is no evidence that its efforts have been more than minimally successful so far in actually reducing waste, although the research is vital in providing a basis for the development of controls that are not voluntary (ie regulations and/or fiscal incentives). Industries as profit maximisers actively seek ways of reducing waste as long as it is in their interest to do so (which may not, for example, include making products more durable); government encouragement is not likely to make them go further on a purely voluntary basis. Government efforts might have more effect on consumers who may be motivated to reduce waste but are, in general, less well educated about methods for doing so.

## **The Committee's conclusions**

With the analysis before them, members considered the merits of each policy approach in the light of their own judgements. An attempt was made to reach consensus on a policy or policies to recommend to the Board, but this proved difficult due to the wide diversity of interests, some sharp divergencies between the views of members representing these different interests, and disagreements between members representing similar interests.

A poll was conducted in which members were asked to state, for each policy approach (and assuming that the optimum variation, as they perceived it, would be used) whether they were strongly in favour; mildly in favour; mildly against, or strongly against. The results of the poll are given in Table 1. The only policy to obtain unanimous support (although not everyone was convinced that it would be effective) was option 13. Option 11 received broad but not unanimous support, as did option 4. On the other hand, there was nearly unanimous opposition to option 1 and fairly broad opposition to option 7 and option 5.

Opinions regarding the remaining policies were fairly evenly split, with the representatives of industry and the Anti-Litter League generally opposing the policies, while the representatives from the EPA and the civic/environmental groups generally gave their support. The sole representative from local government stood somewhere near the centre of the spectrum of recorded views.

On the basis of the poll, the only recommendation that could be made unreservedly was one of encouraging voluntary waste reduction

Table 1. Committee members' assessments of policy approaches

Option		Interests represented												
	Regulations	Environ- mental	Environ- mental	Environ- mental	Civic	Federal govt. (EPA)	Local govt.	Anti- litter league	Glass con- tain- ers indus- try	Glass con- tain- ers indus- try	Paper indus- try	Alu- mini- um indus- try	Plastics indus- try	Metal can indus- try
1	Direct regulation of individual products (non-durables)	X	X	O	X	X	XX	X	XX	XX	XX	XX	X	XX
2	Purchasing regulations for state agencies, etc	OO	OO	OO	OO	OO	OO	X	X	X	X	XX	X	XX
3	Direct regulation of individual products (durables)	O	O	OO	O	O	XX	X	X	X	XX	X	X	XX
4	Minimum warranty requirements	OO	O	O	X	O	X	O	O	O	X	O	O	XX
5	Mandatory disclosure of environment impact	XX	X	OO	O	O	XX	O	XX	XX	X	XX	X	XX
	Financial incentives													
6	Mandatory refunds on beverage containers	OO	OO	OO	OO	OO	X	XX	XX	XX	XX	XX	X	XX
7	Disposal tax by weight	XX	X	O	O	X	OO	X	XX	XX	XX	XX	O	XX
8	Tax on containers	XX	O	O	O	O	X	X	XX	XX	XX	XX	X	XX
9	Disposal tax based partly on weight, partly on units	O	O	OO	OO	CO	X	X	X	X	XX	X	X	XX
10	Value based tax	X	O	O	O	O	O	X	X	X	XX	X	X	XX
11	Variable waste collection/disposal fee	OO	OO	OO	OO	OO	X	O	O	O	O	O	O	XX
12	Subsidy to offset capital costs of converting from one-way to reusable products	OO	O	O	O	O	O	O	XX	XX	OO	XX	X	XX
	Voluntary measures													
13	Encouragement of voluntary waste reduction efforts	O	OO	O	O	OO	OO	OO	O	OO	OO	OO	OO	O
Key														
OO	Strongly in favour													
O	Mildly in favour													
X	Mildly against													
XX	Strongly against													

Source: Adapted from 'Proposed Policies for Waste Reduction in California', prepared for the State Solid Waste Management Board, California 1976

efforts. It was not felt appropriate to translate the views of a simple numerical majority into recommendations from the Committee as a whole;<sup>27</sup> instead, individual members were invited to submit personal statements that were attached to the report.

## Discussion

Based on Committee discussions, the preferences registered in the poll, and the personal statements submitted for inclusion in the report, it is possible to identify some major points of disagreement between Committee members. They were:

- whether, for the purpose of waste reduction, there is any need for government intervention in the working of the 'free' market;
- whether the waste reduction concept simply provides an excuse for imposing new controls on the packaging industry; and
- which, if any, of the measures can be significantly effective without incurring unacceptable costs.

### *The need for government action*

The attitude of each member on this fundamental issue was crucial in determining the outcome of the Committee's deliberations. On the whole, the industry representatives were not convinced of the necessity for any government action and therefore their first preference was to oppose all but the voluntary policies. It was only on the basis that the state might take action regardless, that some were prepared to discuss which of the other policies might be the 'least objectionable'.

<sup>27</sup> One reason is that the composition of the Committee, while not wholly arbitrary, had been subjectively determined by a staff member of the Solid Waste Management Board.

The industry representatives argued that the market system normally tends to minimise waste and that it should be allowed to operate without government interference. One argued that 'our solid waste problem could be aided best by the operation of the free, open market place and its various interactions of technology and competition'. Another commented that 'the market place is the most democratic and efficient mechanism for the allocation, conservation, and development of resources needed by the public'. They contended that waste reduction would reduce the standard of living (implying that throughput is the appropriate measure) and doubted 'that a majority of Californians would support the philosophy that our standard of living must be reduced because we consume more per capita than other nations'.

Other Committee members disagreed; they felt that the market currently fails to prevent the generation of excess waste and that the standard of living would not necessarily be lowered by an appropriate waste reduction programme. The local government representative was most concerned about the shortage of landfill sites; he considered waste reduction a 'supplemental strategy to resource recovery as a means of reducing our landfill needs'. Another member commented that 'we know that solid waste is not going to decrease without help'. The environmentalists were deeply concerned with the need not only to reduce solid waste management costs but also to conserve resources and preserve the environment; they argued that government measures are essential 'to alter the throw-away mentality of the present system'.

#### *Waste reduction and the packaging industry*

The industry representatives (all of whom were associated with packaging) complained that they were the subjects of unfair discrimination. One viewed the whole exercise as 'nothing more than one attempting to provide a reason for recommending mandatory deposits on beer and soft drink containers'. Another argued that the situation is far more complex than many people imagine, suggesting that the case for packaging controls is anything but clear-cut.

Other Committee members did not feel that the packaging industry was being treated unfairly. They pointed out that containers and packaging materials constitute more than one-third of total post-consumer wastes (by weight) and that these are an inevitable target of waste reduction efforts. Moreover, several of the policies considered by the Committee applied to wastes other than those from packaging.

#### *Cost-effective policies*

As mentioned above, some (though not all) of the industry representatives were prepared to consider which of the policies (other than voluntary efforts) would be the least objectionable, and two options (4 and 11) received mild support from them on this basis.<sup>28</sup> The lack of firm information about likely effects gave both sides (ie, those generally sympathetic with the need for waste reduction and those against) the opportunity to support their respective arguments using the same analysis. Thus one of the industry representatives, in justifying his opposition to most of the policies, interpreted the analysis as signifying that 'the effects of these options on the solid waste stream are minimal to insignificant, while the costs to government, industry and the consumer are significant to high'.

<sup>28</sup> The representative of the plastics industry also supported option 7, disposal tax by weight (which would presumably favour his industry over one manufacturing heavier packaging).

This was not the conclusion drawn by the non-industry members of the Committee, who felt that some of the other options could be significantly effective at an acceptable level of costs. However, since each member had a different set of criteria for selection and a different view of how these criteria might be met, their choices of particular policies differed significantly. The local government representative, for example, looked for policies 'most productive in terms of landfill requirements, easy to implement, and presenting the least difficulty in enforcement and administration'; in his mind, this meant that most of the proposed regulatory approaches were unsatisfactory while option 7 (disposal tax by weight, with an exemption for secondary material content) was the most preferred. The civic group representative, who felt that 'a policy should produce a clear reduction in waste volume ... with as little direct intervention or regulation as possible' also gave her strongest support to fiscal rather than regulatory measures, but favoured other options (6, 9, and 11) over 7.

Several measures emphasised the need for some action to be taken soon. One commented: 'While voluntary reduction measures are widely supported, the overall effect of voluntary efforts in reducing the volume of waste has proved to be extremely minimal. It is time for the state of California to step forward and lead the nation in waste reduction with a series of regulations and financial incentives aimed at the problem'. Another argued that 'it is time to do *something* to reduce waste. The longer decisions are put off, the harder it will be to implement any, and the problem grows worse in the meantime'.

## Conclusions

At first glance, waste reduction may seem a fairly obvious and reasonably straightforward approach to take in tackling the solid waste problem. After all, it is not unusual to hear people complaining that goods are 'over-packaged' or that products wear out too quickly; it may seem a relatively simple matter to eliminate 'excess packaging' and to persuade manufacturers that they should make more durable products. Indeed, in a few instances, waste reduction can be accomplished without fuss: for example, the manufacturer who introduced a new milk container that performs as well (if not better) than the existing one but requires less packaging material, hurt no-one (except, perhaps, the suppliers of the material itself) but benefited both himself and those who have to pay for solid waste disposal. His action, it may be noted, was entirely consistent with the working of the market system.

In general, however, waste reduction cannot be so readily accomplished; the benefits do not come without costs. As mentioned earlier, one argument in favour of waste reduction is based on the existence of market breakdowns; there is fairly wide agreement that many (if not most) production and consumption processes cause externalities, and some waste reduction measures can be justified as a means of restoring market efficiency. Nevertheless, even if this reasoning is accepted, there is still room for disagreement on the nature and scale of the 'corrections' necessary; to a large extent, the current debate on waste reduction (as exemplified by the Committee discussions) gives at least the appearance of hinging on this issue.

However, I believe that a much more fundamental issue is involved.

I feel that many of the Committee members, though perhaps not all admitted it, began to realise that if the objectives of waste reduction are to be taken seriously, we must start to question some of our basic values and attitudes, particularly as they relate to our view of material goods. Of course, the implications of doing this are awe-inspiring; it is one thing to accept as 'sensible' Boulding's suggestion that we minimise rather than maximise material throughput, but it is another to face up to the upheavals that would be necessary to move to a system that does this.

It is understandable, therefore, that the Committee was unable to achieve unanimity on anything but the weakest of recommendations. The lack of information on effects was cited as a limitation on their ability to agree on preferred policies, but I share the feeling of one member who commented that attitudes were decisive, rather than knowledge. Even with a 'massive intrusion of hard data and information on the waste reduction topic' (he stated), policy makers would 'still have to decide among alternatives which force us to rethink our basic attitudes about the way we live our lives and the manner in which we consume vital resources'.

My own feeling is that policy makers are not about to face up to this fundamental issue; instead, like the Committee, they will probably continue to debate proposed waste reduction measures as if the issue did not exist and, as result, they may never get to grips with the real problem.