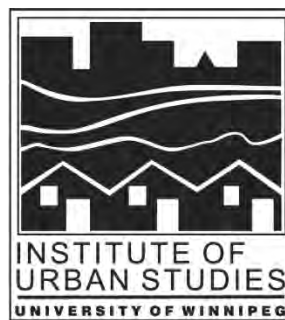


Urban Waste Management: A Review of Stewardship Approaches

Issues in Urban Sustainability No. 4

**by Robert W. Fenton
1994**

The Institute of Urban Studies





THE UNIVERSITY OF
WINNIPEG

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INTRODUCTION

PREAMBLE

Based on a reasonable sampling of the literature, urban solid waste management in North America is in a state of crisis. The following quotations illustrate the type of comments being made:

" While the question of disposal of a city's waste is full of difficulty, it is also full of promise."

"The proper disposal of waste is one of our urgent national problems."

"In recent years, the problems associated with solid waste disposal have become a national crisis. This situation has developed because increasing amounts of wastes are being produced each year and present waste management techniques are not adequate to prevent serious environmental pollution."

"As [our] proliferation of waste continues, places to dispose of it are dwindling. To avoid a crisis everyone needs to accept responsibility for reducing the amount of garbage thrown away. . . ."

"Ministers recognized that waste management is an urgent and pressing national problem. Some jurisdictions are already running out of landfill sites, in part because Canada is one of the most wasteful nations."

Municipalities vow to fight the mega-dump scheme: "What about our children? Our backyard is full."

It is interesting that the perspectives of these quotations span almost a century. The first dates from 1895, the most recent from 1993.¹ Either the preceding diagnoses were incorrect (perhaps the alarm has been raised too quickly, too often) or we must have found a way, temporarily, to live with "one of our most urgent national problems."²

Early diagnosis, strong warnings, and diligent efforts should bring solution of problems. If the same problem resurfaces at some future date, however, perhaps symptoms have been treated and temporary accommodations made. The fundamental root cause of the symptoms has not been excised.

To put the matter another way, the waste component of our economy might be a very adaptive system. When existing patterns of activity threaten the future of the system, sufficient change could occur to relieve the immediate threat apparently without making fundamental change to the system. Thus problems would be identified, change would occur, and the system would persist without the problems being removed.

Our accommodation of the waste disposal problem during the past century has been accomplished with both technological fixes and social shortsightedness. The technological fixes

traditionally involved "disposal" on land, in water, to the atmosphere or a combination of the discharge modes. Various technological innovations have relieved the symptoms by reducing, not the amount of waste generated, but the volumes of waste facing ultimate disposal: shredding, incineration, open burning, reclamation and composting (Glysson *et al.*, 1972). Note these changes focus only on slowing the rate at which a dump is filled up. As well, the disposal technology has moved from the open dump or the landfilling operation, frequently with open burning, to the sanitary landfill.

Solid waste technology was not viewed as a high priority relative to air and water pollution through the first seven decades of the Twentieth Century. Only during the 1960s did "very compelling reasons [emerge] for society to raise the priorities" for solid waste. By the 1970s, the "third pollution" (solid waste) "had come to be regarded as ultimately more of a threat than the other two" (Glysson, 1972, p. 1).

The new priority accorded solid waste disposal obviously has not removed the root cause of the recurring problem, since solid waste is proclaimed a major problem in both the United States and Canada as we start the last decade of the century. In fact, a substantial part of our present problem stems from an improved recognition of the interaction among the "three pollutions" and the identification of unforeseen water and air pollution associated with the "new technologies."

The social shortsightedness is illustrated in the title of a historical article by Melosi: *Out of Sight, Out of Mind: The Environment and the Disposal of Municipal Refuse* (Melosi, 1973); and by Glysson *et al.*, who state:

. . . most of us take a magical view of solid waste disposal, in so far as we agree to view it at all. Indeed, our chief objective has been NOT to view it or even to think about it, and no wonder. All peoples through all previous ages have shared a common attitude toward solid wastes, an attitude neatly formulated in the old saying: OUT OF SIGHT, OUT OF MIND. Or, not seeing is not believing (Glysson, 1972, p. 2) (Emphasis in original)

To extend Glysson's thought, if the symptoms are controlled, the public puts low priority on solving the root problem. As many seriously ill people have discovered, however, prolonged treatment of symptoms, and not diseases, can lead to substantially reduced life expectancy.

Our myopia could well be caused by our faith in technology. The garbage problem has been viewed by the solid waste industry as a technical problem, which will be cured by technology. Many observers believe, however, that the root of this problem is embedded in our high consumption society.³ If this perception is correct, the solution will require changes in both technology and social behaviour.

This pattern of treating symptoms rather than root causes is itself a symbol of a society wrestling with a clash of "world views." In this case, a world view describing a high consumption lifestyle clashes mightily with a view that sets a priority for environmental maintenance and protection; a lifestyle that emphasizes new goods, convenience, and disposability resulting in high *per capita* waste generation, vs. a style which emphasizes preservation, quality, and reusability resulting in low *per capita* waste generation. The challenge that each of these views provides the other is major and fundamental; a subversion of the other world view. As Thompson points out, the typical response when world views clash in this fashion is a "conspiracy of blindness" (Thompson, 1979, p. 3) until the clash forces change; either an adjustment for accommodation or a fundamental change of values which brings consistency between the two views.

In his monograph on social anthropology, appropriately entitled *Rubbish Theory: The Creation and Destruction of Value*, Thompson argues that we "only notice rubbish when it is in the wrong place." He goes on to distinguish between rubbish and residuals:

The discarded but still visible, because it intrudes, forms a genuine cultural category of a special type—a rubbish category. That which is discarded but not visible, because it does not intrude, is not a cultural category at all, it is simply *residual to the entire category system* (Thompson, 1979, p. 92) (emphasis in original).

The quotations on page one show that over the past century, rubbish has become visible and intruded into our consciousness on several occasions. To date, however, the intrusions have not brought a reconciliation of the two competing world views. We have accommodated, only temporarily, the intrusive, discarded residuals within the dominant world view of high consumption.⁴

In this sense, neither the technical fix nor social shortsightedness accommodations of an "urgent national problem" provide a good basis for reconciling the two world views; for increasing the sustainability of urban life. As rubbish intrudes again and we increasingly recognize the failure of our accommodations to solve "the waste problem," we set the stage for a revised world view including initiatives which will increase sustainability. These initiatives treat the problem as a social or socio-technical issue of materials policy rather than simply a problem of sanitary engineering or even of narrowly based market economics. The approach involves negotiations among a range of groups with a direct stake in the issue to set new rules of the game for firms and governments offering products and services to the public and for the public itself as well. Fundamental to these new rules, to the new world view, is the concept of Stewardship. This "Stewardship Approach" will open leads to root causes closed off by the more purely technical or narrow market approaches emphasized in the past. It also will lead to the heart of the concept of sustainable development.

**BOX 1
STEWARDSHIP**

The concept of "product stewardship" is now a decade old in Canada. It began in the spring of 1984 as a program of the Canadian Chemical Producers' Association known as the "Responsible Care" program. Responsible Care set out a **guiding principle** and **six codes of practice** to be followed by all members of the Association. The program called for an implementation plan, targets for achievement, and semi-annual progress reports.

The Government of Canada has embraced the concept and has established an "Environmental Stewardship Program" administered by Environment Canada. Industry Science and Technology Canada commissioned the Government Consulting Group to undertake a review of the concept of product stewardship and its implications for Canadian industry. The study concludes that "Product Stewardship is one of those rare ideas which could change the way industry goes about business. It could radically alter the relationship between industry and its customers and, indeed, the role of industry in society" (Government Consulting, 1991, p. ii).

Internationally, the concept of Product Stewardship is an offshoot of the Total Quality Management theme which has so radically altered the way in which business and industry is conducted. The conceptual definition suggested by the Government Consulting study is:

Product Stewardship means that a company takes active responsibility for managing the life-cycle of its products with proper regard to the environmental rights of the public (Government Consulting, 1991, p. 4).

OVERVIEW AND GOALS

This literature review is intended to assist in the establishment of the new world view; to contribute to the consolidation of the broader socio-technical basis for increasing urban sustainability. To do so, one of the more recent examples of the socio-technical basis is used to provide a framework for discussing the basic elements of the Stewardship Approach. Specific goals are to highlight the nature of the proposed cure, rather than the sources of symptomatic relief; to trace the genealogy of its elements through the literature; and to build consensus for the treatment. Achieving consensus has been, and will continue to be, an important though difficult task. As Golueke and McGauhey said in their 1970 report, *Comprehensive Studies of Solid Waste Management*:

One of the most elusive facets of the problem of solid wastes is the shifting cultural attitudes which tend to disorient the public to rational solutions and to compound the already considerable task of education and communication (Golueke and McGauhey, 1970, p. II-6).

The framework for this Review is given by the Ontario Waste Reduction Advisory Committee report entitled: *Resource Stewardship in Ontario—A Shared Responsibility*. This "Ontario Resource Stewardship Model" encompasses many ideas developed in Ontario and elsewhere over the past 25 years (Ontario WRAC, 1992-1). It develops a specific set of stewardship proposals which will facilitate the discussion of a broad set of issues underlying the Stewardship Approach.

The Review will range quite widely in time and subject. A number of other models, in addition to the Ontario Resource Stewardship Model, are used to highlight features of the Stewardship Approach. As an aid to the reader, the most important of these models are listed in Table 1.⁵ The reader should be aware that some of the more recent models still are under development and subject to revision and further discussion.⁶ The details of any policies subsequently adopted could vary substantially from those discussed here. Detailed evaluation of actual policies to be implemented or trade-offs among policy elements is beyond the scope of this Review.

The remainder of this Review has three primary sections. The first, **Sustainable Waste Management?**, looks at the topic of waste management from narrower perspectives of urban management and environmental protection using the historical situation in the Greater Toronto Area to exemplify the issues. The second primary section, comprising the bulk of this Review, discusses the **Stewardship Approach**. After describing the Ontario Resource Stewardship Model, the second section examines the cornerstones of the Stewardship Approach in three major subsections: **Sustainable Development, Resource Conservation, and Responsibility for Stewardship**.

TABLE 1
OVERVIEW OF MODELS FOR THE STEWARDSHIP APPROACH

ADVISORY COMMITTEE MODELS**MANITOBA**

Waste Minimization Strategy	1990
-----------------------------	------

ONTARIO

Resource Stewardship Model	1992
----------------------------	------

Shared Approach Model	1992
-----------------------	------

Organic Wastes Action Plan	1992
----------------------------	------

INDUSTRY**GROCERY PRODUCTS MANUFACTURERS OF CANADA**

Packaging Stewardship Model	1992
-----------------------------	------

ONTARIO SOFT DRINK ASSOCIATION

Waste Minimization Action Plan	1991
--------------------------------	------

OTHER**FENTON**

Stewardship-Management Model	1993
------------------------------	------

GLYSSON/ UNIVERSITY OF MICHIGAN

Socio-Technical Model (The Problem of Waste Disposal)	1972
--	------

OFFICE OF TECHNOLOGY ASSESSMENT

Waste Prevention Model (Comprehensive National MSW Strategy)	1992
---	------

SCIENCE COUNCIL OF CANADA

Conservator Society Model	1977
---------------------------	------

THOMPSON

Rubbish Theory	1979
----------------	------

- A. **Sustainable Development** is the fundamental objective in a Stewardship Approach. The origins of the idea and its application to Canadian waste management thinking are explored in this section.
- B. **Resource Conservation**, particularly **Conservation of Materials** appears in many guises: **Materials Policy** including ideas about "Strategic Materials"; **Industrial Materials Management**; **Preserving Secondary Materials Policy**; **Transportation and Fiscal Policy**.
- C. **Responsibility for Stewardship** roles for Producers, waste Generators, Municipalities, Provincial Governments and the Federal Government are discussed.
The final primary section gives some thoughts about
- D. **The Way Ahead for the Stewardship Approach**.

SUSTAINABLE URBAN WASTE MANAGEMENT?

Urban waste management, in the narrowest sense, consists of collecting, processing (including incineration), treating and depositing waste in a landfill. The sustainability of this process depends on the availability of two things: (1) a location to deposit the waste; (2) money to meet the costs of the waste management, including the cost of constructing and operating environmentally acceptable facilities and depositories as well as the cost of transporting waste to them.

These are important issues and much of the waste management literature addresses the various components of the process. The "crisis" of recent years is founded in questions of sustainability in this sense. Increasingly stringent definitions of environmental acceptability have raised the cost of constructing and operating depositories, forced early closure of existing landfills and reduced the number of feasible locations for replacement landfills. As well, public resistance to the siting of new landfills has delayed development of replacements even further and increased transportation costs even more. Sustainable urban waste management requires that these two issues, location and cost, be resolved.

The most significant Canadian case of this type⁷ is the Greater Toronto Area which includes the regional municipalities of Metro Toronto, Durham, Halton, Peel and York as well as local municipalities. The controversy over waste management in the area has continued for at least 35 years, but has become more intense since Metropolitan Toronto was given power over waste disposal in 1967 (CUPE, 1989, p. 49-50). A regional waste management report, received in the spring of 1967, identified the need to establish new landfill sites.

Controversy surrounding the location of landfills stretched through the 1970s. CP Rail made a proposal in 1972 to ship 400,000 tons per year of Metro waste by rail to a landfill in Port Hope

(CUPE, 1989, p. 34). In 1980, a privately owned landfill at Maple Pits (now Keele Valley Landfill) was approved. The site was purchased by Metro Toronto in 1983. Due to the rapidly expanding economy in the 1980s, closure of neighbouring private landfills, and landfill tipping fees at Keele Valley lower than at other Greater Toronto Area sites, much greater volumes of commercial waste (some from outside Metro Toronto) were received than had been planned for—thus reducing the life of the site (CUPE, 1989, p. 53-56). Once again the rail option emerged, this time the proposed destination was Kirkland Lake, Ontario (Davidson, 1993, p. 34). The shortage of landfill capacity stimulated tipping fee increases to among the highest in North America at a peak level of \$150 per tonne (Calvert, 1993, p. 29). The results were to slow the dumping of commercial waste at the Metro sites with substantial amounts of the material moving to New York state; and to erode the revenues Metro Toronto used to subsidize waste reduction programs.

The movement of waste across municipal and provincial boundaries became a major political issue with the Province of Ontario stepping in to resolve the situation. In June of 1991, the Province issued a plan to meet the immediate waste management crisis in the area while long term issues were being resolved (McRobert, 1992, p. 8). The Waste Management Act of 1992, (WMA of 1992) set up a Crown corporation, the Interim Waste Authority Ltd., to locate and develop three landfill sites to serve the entire Greater Toronto Area. The Authority has the power of expropriation to acquire sites. The sites are subject to review under the Environmental Assessment Act but the WMA of 1992 provides for limitations on the issues to be considered⁹ (McRobert, 1992, p. 18-19; McRobert, 1993, p. 31). The sites were announced in late 1993 and drew protests from residents living in the vicinity (Tobin, 1993). In the meantime, the debate continues. Incineration still is ruled out as an option; the WMA of 1992 prevents the rail-haul to Kirkland Lake from being implemented, but lobbying in favour of it is under way (Elie, 1993, p. 15; Davidson, 1993, p. 35); and tipping fees are being reduced by 40 percent at Metro Toronto's landfills to encourage more waste to be deposited there rather than in competing landfills (Recycling Update, 1993-2, p. 20) in order to rebuild Metro Toronto's revenue base.

The literature on urban management, sanitary and environmental engineering, environmental protection and waste management is full of discussions of situations similar to that of Greater Toronto—on how to make waste management sustainable. This literature comprises reports commissioned by interest groups, reports by governmental and regulatory agencies and articles in the leading academic, professional and trade journals. A recent sample included surveys of remaining landfill capacity (Wallace Associates, 1990); new estimates of the damage from landfill emissions (US EPA, 1988, vol. II, pp. 4-68); new methods of protecting the environment from landfill emissions (US OTA, 1992, pp. 271-90); new methods to reduce the cost of collecting, treating, processing,

transporting and depositing waste in the landfill (Morris and Platt, 1987; Blackwell and Neering, 1992). Increasingly the success or failure of various tactics of diverting waste from the landfill is receiving substantial space in journals and professional studies. For example, backyard composting has been a popular topic in the last two years (Glenn, 1993-1) as have various methods of collecting residential recyclables—whether it be source separated at curbside or depots (EPIC/OE, 1992; Alderden, 1992; Apotheker, 1992-1 ; Poole, 1992), cocollection of commingled recyclables (Steuteville, 1993-3), mixed waste collection and central sorting (Apotheker, 1991-1; US EPA, 1991), or multi-stream collection of recyclables, wet streams (compostable) and refuse (Argue, 1993; Palombella, 1992).

THE STEWARDSHIP APPROACH

The cornerstones of the Stewardship Approach are:

- sustainable development
- resource conservation policy
- responsibility for stewardship.

Each of these concepts is discussed extensively in the literature and is a prominent feature of the Ontario Resource Stewardship Model. However, before exploring the treatment of the concepts in the literature, the following section outlines the Ontario Model.

THE ONTARIO RESOURCE STEWARDSHIP MODEL

The Ontario Resource Stewardship Model was developed by the Ontario Waste Reduction Advisory Committee (WRAC, The Advisory Committee)⁹ in 1992. The Ontario Advisory Committee called for a complete rethinking of the waste management system in order to move away from an unsustainable regime. While acknowledging the shortage of disposal capacity for the materials "deemed expendable" by society, particularly in southern Ontario, it found that "(d)epletion of resource and energy supplies, along with the environmental degradation resulting from their over-utilization, must be identified as the most important consideration in managing wastes" (Ontario WRAC, 1992-2, p. 1). "Resource Stewardship" is defined as: "The acceptance of responsibility for resource and energy conservation, and secondary resource management, by those who benefit from the use of resources" (Ontario WRAC, 1992-2, p. H-4). This is not a new thought, but it is significant given the consultative multi-stakeholder process used to reach the position.¹⁰

BOX 2
SUMMARY OF THE ONTARIO RESOURCE STEWARDSHIP MODEL

The Model incorporates two distinct segments: one for "dry recyclables" (known as the Shared Approach); one for wet materials and dry process wastes (the Organic Waste Action Plan). Responsibility for the former would be shared by **Producers** and **Generators**. Responsibility for the latter "would remain the responsibility of their respective public- and private-sector **Generators**." Each segment is based on the premise that "all those who benefit from manufacturing and using goods should bear a share of the responsibility for reducing waste, reusing products and packages, and recycling and composting materials."

Accountability is maintained in the Model through a mix of instruments. **Producers** would face negotiated compliance to meet target—augmented by economic measures such as a variable unit charge on output. **Generators** would face direct economic measures including variable user fees for waste collection and disposal services and recyclable material collection services.

The Shared Approach for dry consumables is of major interest to this Review. Under the Shared Approach, both functional and financial responsibilities would be split among relevant stakeholders.

FUNCTIONAL

Producers: through a third party (an Industry Funding Organization—IFO): establish a network of materials recovery facilities; develop markets for recovered secondary materials; meet specific 3Rs targets negotiated on a sector by sector basis.

Generators: source separate dry recyclable materials.

Municipalities & Contracted Haulers: collect and tip source separated materials at recovery facilities for no charge; collect and tip garbage at landfills.

Provincial Government: establish "back drop" regulations to ensure all producers participate in the initiative; negotiate sectoral 3Rs commitments on a timely basis; amend regulations to permit and encourage municipalities to charge user fees for collection of garbage and recyclable materials.

FINANCIAL

Producers: pay a variable unit charge to the IFO for each unit of product sold. The user charge would vary according to the "3Rs ranking of the product" as well as the associated waste management costs. The fees would fund the net cost of the network of materials recovery facilities.

Generators: pay all fees associated with collection and tipping of garbage and recyclable materials.

Municipalities & Contracted Haulers: charge for collection services for garbage and recyclable materials including any tipping fees levied.

The Ontario Resource Stewardship Model incorporates two models previously advanced by the Advisory Committee:

- The Organic Wastes Action Plan (Ontario WRAC, 1992-3)
- The Shared Approach Model (Ontario WRAC, 1992-1).

The Organic Wastes Action Plan

The organic materials component of the waste stream does not generate the same intensity of discussion as the "dry recyclables," defined in the following section. The organic materials literature highlights various technologies for composting: static, active, aerated, passively aerated, backyard; quality of compost re: contaminants and nutrients; and environmental emissions such as leachate and odour. Source reduction activities such as mulching mowers and slow-growing grass also warrant discussion. Of course, various methods of collecting organics from kitchens, yards and non-residential establishments receive substantial attention in the literature.

Other than commenting on the responsibility of various stakeholders for managing organic materials (see below), this Review will not consider further the important question of organic materials management. Readers particularly interested in the topic are referred to *BioCycle* magazine, *Compost Science and Utilization* magazine and *From Waste to Resource—Composting in a Sustainable Society* (Compost Council, 1992).

The Shared Approach Model

The Shared Approach model considered the "traditional" areas for recycling policy: residential and Industrial-Commercial-Institutional (ICI) recyclables. These include a range packaging materials and printing papers and are identified as the "dry recyclables."

Box 2 summarizes the major features of the Ontario Resource Stewardship Model with particular reference to the Shared Approach model for "dry recyclables." The relationship between the major features identified in Box 2 and the Stewardship Approach is discussed throughout this Review. The section Responsibility for Stewardship expands on the information shown in Box 2.

This Review now looks at each of the three cornerstones of the Stewardship Approach in turn.

SUSTAINABLE DEVELOPMENT

The Advisory Committee notes the Brundtland Commission's call for the integration of economic and environmental factors in decision-making to ensure sustainable development. The Advisory Committee suggests that in terms of waste management, the criterion implies a new

emphasis on resource and energy conservation. If the 3Rs¹¹ hierarchy were built into the materials handling system of the economy, and "the loop" were closed by incorporating reclaimed materials into new products, any given level of economic activity would generate a minimum amount of waste. They note that this would reduce the throughput of virgin resources exploited by the economy and hence reduce the rate of depletion ensuring more resources for future generations¹² (Ontario WRAC, 1992-2, p. 2).

Although our present attachment to the concept of sustainable development arises from the report of the Brundtland Commission in 1987 (WCED, 1987), the general idea is substantially older and has appeared in several different forms in the literature. Van Kooten traced the genealogy of sustainable development back to the early 1950s and the pioneering work of S.V. Ciriacy-Wantrup (van Kooten, 1993, chap. 8). Ciriacy-Wantrup wrote extensively on the concept and the implications of "conservation," defined to be a shifting of the inter-temporal distribution of resource use toward the future, i.e., consuming less now so that future generations would have more¹³ (Ciriacy-Wantrup, 1963, p. 51).

Van Kooten also credited Anthony Scott with developing the concept further (van Kooten, 1993, p. 167):

Conservation is a public policy which seeks to increase the potential future rates of use of one or more natural resources above what they would be in the absence of such policy, by current investment of social income. The word investment . . . covers not only such policies as investing the social income in restoration, education, and research, but also policies of reservation and hoarding of stocks (Scott, 1973, p. 30).

Other related ideas also have been discussed in the literature. For instance, Lester Brown (1984-1, p. 2) talked of a sustainable society as: "one that shapes its economic and social systems so that natural resources and life-support systems are maintained." The Science Council of Canada defined a Conserver Society:

The concept of a Conserver Society arises from a deep concern for the future, and the realization that decisions taken today, in such areas as energy and resources, may have irreversible and possibly destructive impacts in the medium to long term. A Conserver Society is on principle against waste and pollution (Science Council of Canada, 1977, pp. 13-14).

In the area of waste management, Free cited the *World Conservation Strategy* and the Science Council of Canada's Conserver Society in its discussion of social perspectives of recycling in Alberta (Free, 1986, p. 1); the Manitoba Recycling Action Committee developed its work around the concept of sustainable development (Manitoba RAC, 1989 and 1990) and the Ontario Ministry of Environment published *Towards a Sustainable Waste Management System* (1990).

It should not be surprising that sustainable development is a central point of discussion for Canadian waste management planning. In 1986, the Brundtland Commission briefed the Canadian Council of Resource and Environment Ministers (CCREM)¹⁴ on the importance of developing policies "consistent with future as well as present needs." Later that year, CCREM set up a National Task Force on Environment and Economy to work towards integrating environmental concerns into national economic planning. It is of course the members of CCREM who are responsible for waste management policy in their respective provinces (Paul Brown, 1992, p. 33).

The Canadian Council of Ministers of the Environment (CCME), the successor to CCREM, followed up on these initiatives by establishing a National Task Force on Packaging in 1989. The mandate of the Task Force was to "develop a National Packaging Protocol by early 1990, which sets targets and schedules for the minimization of packaging waste and contributes to a 50 percent overall reduction in waste generation by the year 2000" (emphasis in original) (CCME: NTFP, 1989, p. 1). The Protocol set out six national policies with respect to packaging designed to achieve the 50 percent reduction objective (CCME, 1990). Policy #5 of the Protocol called for implementation of regulations ". . . as necessary to achieve compliance with these regulations" (CCME: NTFP, 1989, p. 3).

Two items of note arise from this review of sustainable development. First, from this perspective sustainable waste management involves much more than finding a place to deposit garbage at reasonable cost. Second the concepts of sustainable development while appearing "new and trendy" have already received substantial review, development and discussion.

RESOURCE CONSERVATION POLICY

Resource conservation in the Ontario Resource Stewardship Model implies the Conservation of Materials, although energy conservation is generally a joint result. This emphasis is distinct from the idea of "resource recovery," a term often used in recent years to describe incineration of waste in boilers designed to recover the energy embodied in waste through the generation of steam and electricity.

**BOX 3
ON RUBBISH THEORY**

In his monograph entitled, *Rubbish Theory: The Creation and Destruction of Value*, Thompson provides us with a sense of the cultural component of Materials Conservation. Thompson identifies three categories of objects: durable, transient, and rubbish. The association of an object with a particular category is culturally and socially determined. Durable items have increasing value and continue to be in high regard, and hence likely conserved. Transient items have declining value over time (Thompson, 1979, pp. 7-11) and likely will not be conserved. Unlike the real life world of waste management, not all transient items become "garbojunk" (Georgescu-Roegen, 1980, p. 37) that has negative value. In Thompson's ideas, *some* transient objects become "rubbish"—a covert category with objects of zero and unchanging value existing in "a timeless and valueless limbo" until such time as they transfer to the durable category by being socially rediscovered. What we need to do is prevent transient items from becoming garbojunk—to stop their slide in value at zero, making them rubbish—and then accelerate the process of rubbish becoming durable. "For an item [to move from rubbish to durable], it must leave its timeless limbo and acquire real and increasing expected life-span, and since its is visible must also discard its polluting properties" (Thompson, 1979, p. 26).

The Conservation of Materials is a central idea in the literature of sustainable development. For instance in a 1993 policy summary, the Waste Caucus of the Ontario Environment Network concludes:

. . . that a fundamental shift is needed from our present focus on waste management to a focus on conservation and appropriate use of resources. Only in this way, can we achieve a wasteless society. This approach will also significantly contribute towards solving many of the other environmental, economic and social problems we face (Jackson and Wallace, 1993, p. 1).

And in 1989, the Institute of Local Self-Reliance in the United States commented: Even if we could snap our fingers and magically make our used materials vanish, we would only reinforce the wastefulness that now jeopardises our planet. Materials recovery, not materials destruction, is the solution (Anon., 1989, p. 1).

Thompson's ideas about Rubbish Theory also are quite consistent with the ideas of Conservation of Materials and resource conservation (see Box 3). For instance, even transient, single-use, aluminum beverage cans might be *perceived* as durable, and worthy of conservation,¹⁵ if the social value of the aluminum is recognized. As the world's stock of unexploited resources is continually reduced and the environmental impact of emissions from the production process becomes increasingly obvious, used beverage cans will be "socially rediscovered" as durables and their social value likely will increase as the social cost of virgin aluminum increases. (From the perspective of the aluminum beverage can industry, the rediscovery will be viewed as old news). This is not a new idea to economists. For instance, economists talk about this process in terms of a dynamically efficient market and the optimal level of recycling (Tietenberg, 1992, p. 188). (However, due to market imperfections, the efficient and optimal levels frequently are not reached). What is important in *Rubbish Theory* is the recognition that cultural and social factors are very important in the transient used aluminum beverage cans "becoming durable."

Conservation of materials and energy is a critical component of the Stewardship Approach and the world view on sustainability. Many parts of the Ontario Resource Stewardship Model are designed to contribute to the goal of resource conservation. The idea of Conservation of Materials is expanded in the following subsections of this Review:

- materials policy including ideas about "strategic materials"
- industrial materials management focusing on prevention of waste, reclamation of scrap and recycling
- preservation of the quality of secondary materials
- changes in government transportation and fiscal policy.¹⁶

Materials Policy

The importance of materials policy in the Ontario Resource Stewardship Model is identified by a subtle change from the structure of previous discussions. The Advisory Committee does not talk simply of recycling as an important part of an integrated waste management system. It identifies a need for *both* a secondary resources management program *and* a waste management program.

A recent working paper from the Program for Solid Waste Policy at Yale University shows a similar change. It notes that to make integrated solid waste management successful, and to achieve the goals set within the waste management hierarchy, requires a change of thinking by solid waste managers. They must begin to think about *managing resources* rather than *managing garbage*. "Implementing source reduction programs and creating real market development opportunities means addressing solid waste from both a solid waste and production system perspective, as part of an overall materials policy" (Schall, 1992, p. 4).

Also in the United States, a 1989 report by the Congressional Office of Technology Assessment (US OTA) identifies materials and energy conservation as national goals and calls for federal involvement with "materials management." Materials management is the second component of US OTA's vision of a comprehensive national MSW strategy—in addition to more traditionally defined solid waste management. Federal involvement is appropriate because of federal powers over interstate and international commerce (US OTA, 1992, p. 9).

In Canada, the Science Council of Canada (SCC), four years before it coined the term Conserver Society, called for the Secretariat of Canadian Council of Resource and Environment Ministers (CCREM) to be strengthened and renamed as a "National Resource Management Authority" (NRMA). The new Authority would be a multi-stakeholder forum for the discussion of policy alternatives which would later be considered by CCREM.

This NRMA should develop and coordinate long-range policies for integrated management of resources and the environment, and should be concerned with the development of policies for prudent and efficient use of both renewable and non-renewable resources (SCC, 1973, p. 32).

The Council also made several recommendations to the federal government on **Materials Conservation**. For example, federal managers should improve information on base material flows, "Resource recovery may be regarded as a second generation mining industry and this information as equivalent to the Geological Survey" (SCC, 1977, pp. 77-80).

Materials policy and resource conservation appear also in the academic literature of the 1970s. For instance, in a 1977 monograph for Resources for the Future entitled *Conservation and Economic Efficiency: An Approach to Materials Policy*, Talbot Page recognizes the need for material resource

stewardship if inter-inter-temporal or inter-generational fairness is to be achieved. Even after correcting the economy for inefficiencies (later sub-sections of this review discuss some of these inefficiencies) which cause too much virgin material extraction, too much waste generation and disposal and too little recycling, Page finds that market forces alone could "let the economy drift into unlivable futures" (Page 1977, p. 211). He calls for an explicit materials policy meeting a minimal conservation criterion "to keep the resource base intact over time" (Page, 1977, p. 212).

An earlier, 1972, socio-technical review of the solid waste disposal problem by the School of Engineering at the University of Michigan commented that the primary incentive for enhanced reclamation and recycling was not a shortage of disposal space but an interest in resource conservation.

The solid waste problem is, after all, a secondary problem, a by-product of our affluence. By contrast, the problem of resource conservation is primary. Without adequate resources, we wouldn't be troubled very long by affluence or any of its byproducts (Glysson, 1972, p. 5).

The U.S. legislative agenda also focused on materials policy. The primary purposes of the Resource Conservation and Recovery Act (RCRA) of 1976 included: "[to] maximize utilization of resources recovered from waste and to encourage resource conservation" (Public Law 94-580(1976), Subtitle D [Subchapter IV, RCRA, Section 4001]), (Kovacs and Klucsik, 1977, p. 231).

An earlier piece of legislation, the Resource Recovery Act of 1970 established a National Commission on Materials Policy in the US. The purpose of the Commission is to:

. . . enhance environmental quality and conserve materials by developing a rational materials policy to utilize present resources and technology more efficiently, to anticipate the future materials requirements of the nation and the world and to make recommendations on the supply, recovery and disposal of materials. [Further to] recommend incentives (including Federal grants, loans and other assistance) and disincentives to accelerate the reclamation or recycling of materials from solid waste (Resource Recovery Act of 1970, Public Law 91-512, Section 202, Title II; and Section 205[a] Title I; Glysson, 1972, pp. 127-28).

Another aspect of materials policy, concern over materials imports, continues in the context of the debate about the United States trade deficit. An analysis completed in 1989 by professional staff from the City of Philadelphia examined the impact on the U.S. trade deficit of increasing the level of recycling. They estimate, that in 1986, the U.S. landfilled an amount of aluminum scrap valued at more than 50 percent of the value of unwrought waste and scrap imported (throw aways of 1 million tons, valued at in excess of \$1 billion, imports valued at \$1.8 billion). Recycling increases

would further reduce the trade deficit by reducing the imports of energy to the U.S. (Young and Campbell, 1989, p. 144).

Strategic Materials

A subset of concern about materials policy is the supply of strategic materials. Particularly, this has been a concern of the United States given its position as a major importer of raw materials and its concern about global strategies. During wartime, however, the issue also has been of concern in Canada.

The U.S. government, under the Critical Materials Stockpiling Revision Act of 1979 and the National Materials and Minerals Policy, Research and Development Act of 1980, has established specific provisions for maintaining a reserve "adequate to supply the first three years of a conventional war, after subtracting the amounts available from domestic sources and secure foreign sources" (Tietenberg, 1992, p. 197). Tietenberg shows that these revisions were simply part of on-going legislative action by the U.S. Congress in this area. He cites previous legislation from 1966, 1954 and 1946, and a 1982 study by the U.S. General Accounting Office on further legislative actions required (US GAO, 1982).

Tietenberg suggests also that in the case of resources for which an economy is a net importer, the social cost of using imported virgin rather than domestically generated secondary materials is higher than the market price—because of a risk premium to reflect the possibility of interruption of supply. This is an example of market failure with prices failing to adequately measure social costs. (This failure arises because of incomplete information, or differing objectives of individuals and state, or lack of a mechanism to incorporate the risk of embargo into the market price). He suggests further that economic efficiency could be improved by imposing a tariff on imported strategic materials and using the proceeds to fund a strategic materials stockpile. The implication is that the tariff would influence purchasers of raw materials to access domestic sources, including secondary material supplies, and that the stockpile would insulate, in the short run, against embargoes that target the United States. The stimulus for materials recovery would come not only from the import replacement but also from possible purchases to build the strategic stockpile (Tietenberg, 1992, p. 194). Sustainability would be enhanced to the extent that the domestic resources referred to above are secondary resources. (Advocates for free trade probably find that these arguments "show how easily environmental concerns can be hijacked by protectionists").

In view of the earlier discussion of U.S. materials policy *circa* 1970 and 1976, the following comparison, made in 1971, by the Vice President of Research at the State University of New York provides the climate within which the legislation was passed:

Of the 36 most important industrial raw materials consumed by our manufacturing industries, the United States is self-sufficient in only 10 . . . and must import all or part of the remaining 26. The Soviet Union, on the other hand, is self-sufficient in 29 and needs to import only 7 of these materials" (US OTA, 1992, p. 14).

During wartime, of course, the demand for strategic materials increases substantially—indeed the range of materials considered strategic likely expands as well. During the two world wars of this century, the allies of Britain, the Commonwealth and the United States, increased their use of secondary materials substantially. Industrial sources of "home" and "prompt" scrap (factory scrap) were monitored closely and returned to production of war materiel. Similarly materials were salvaged from household and commercial waste and diverted to war production. The U.S. set up the Waste Reclamation Service in 1917 to overcome shortages of materials for the war effort. Using the motto "Don't Waste Waste-Save It," this effort was modelled after the National Salvage Council in Britain. A similar campaign was organized in the U.S. during World War II by the Salvage Division of the War Production Board (Hoy and Robinson, 1979, p. 3).

In Canada, similar campaigns were developed. Under direction of the Patriotic Salvage Corps of Winnipeg, *per capita* collection of "Salvage" (note the use of the upper case for Salvage) in Winnipeg was more than twice as great as any other city in Canada. The Corps offered boulevard collection for a broad range of materials: paper, glass, metal, fabric, fats, rubber and bones. The Corps was established as a community organization and was structured around a series of district zones in Greater Winnipeg. Block Captains were appointed to deliver information and encourage participation (Winnipeg Patriotic, 1945). As Maclaren notes, however, the enthusiasm was not maintained:

During the world wars, the level of resource extraction was much higher than it is today because of the scarcity of virgin materials and restrictions on imports. However, once these periods of national crisis ended, the value of waste declined again and the emphasis on disposal returned (Maclaren, 1991, p. 28).

Thus it appears that during a national crisis such as a war, the world view temporarily can shift from a lifestyle emphasizing high levels of personal consumption to a lifestyle oriented towards conservation of materials and reduced *per capita* waste generation from consumption and manufacturing. After the crisis of war was relieved, the "conspiracy of blindness" cited by Thompson returned.

Industrial Materials Management

As an additional tool for Resource Conservation under the Ontario Resource Stewardship Model (Ontario WRAC, 1992-2, p. 11), new initiatives, in the form of producer levies, were proposed to encourage manufacturers (brand owners):

- to redesign their products to achieve targets for reduction, reuse, and recycling, reflecting the 3Rs hierarchy (see n. 11); and
- to increase the secondary materials input to their production process, that is to "close the loop."

The structure of these initiatives will be discussed later. For the present, simply note that the Advisory Committee continued to focus on an issue that according to some reporters has long been basic industrial practice. As a recent advertisement in the trade literature proclaimed, "SCRAP IS PROFIT IN RAW FORM" (Battenfield, 1992, p. 38). The literature on this topic is very large, probably exceeding in size and longevity the literature on municipal solid waste. Increasing the "efficiency of resource utilization" is one of the major elements of industrial engineering.

A favourite theme in this literature is "profiting from pollution prevention" which appears in the title of both a Canadian guide to industrial waste reduction and recycling (Campbell and Glenn, 1982) and a guide from the Institute of Local Self-Reliance (Huisingsh, 1986). The theme appears also in a publication providing selected examples of waste prevention activity in the Canadian packaging industry. For instance, Quaker Oats reduced its waste disposal from ten million pounds in 1987 to two million pounds in 1990. Of this amount 44 percent was by source reduction and reusing, 36 percent by recycling (28% food based waste, 8% Old Corrugated Cardboard [OCC], *etc.*). Financial benefits were \$328,000 in saved waste disposal costs (includes sales of food wastes) and \$648,000 in yield improvements. The interesting feature of this case is that of the one million dollar contribution to profits, almost two thirds comes from "yield improvements"¹⁷ (OMMRI, 1991, p. 55).

Even though there has been a flurry of literature on this topic during the last decade, the topic has been featured prominently in the literature for some time. For instance, *Trade Wastes: Its Treatment and Utilization* appeared in 1902 (Naylor, 1902), and "Factory Losses and Wastes: Quest and Reduction" appeared in *Industrial Management* in 1925 (Summis, 1925). Lipsett wrote *Industrial Wastes and Salvage* in 1951 and a second edition was published in 1963 (Lipsett, 1963). Colten traces the historical development of waste minimization by industry starting in the nineteenth century when incremental profits were again the goal (Colten, 1989).

Academic writers also have investigated this topic. Kirkland, in a study optimistically entitled *Municipal Recycling Comes of Age*, distinguishes between "recycling" and the "salvage of processing

and fabrication scrap." The former focuses attention on the post-consumer waste stream which he views as the most obvious problem facing solid waste managers. The latter, "which is already occurring at a significant rate, is termed 'increased efficiency' of resource utilization" (Kirkland, 1973, p. 1).

Russell (1971) and Anderson (1987) look at this question from the behaviour of a firm facing a two-stage decision in terms of its production process choice. First, the firm will analyze the raw materials and techniques required to create the desired products. This will yield interim estimates of the profits from production. Second, the firm will analyze the cost and revenue implications of the removal of residuals generated in the first stage. Both stages are iterated until the global profit maximization is reached.

The University of Michigan socio-technical analysis of waste management, mentioned earlier, also examined the question of in-plant waste by developing the distinction between avoidable and unavoidable waste. *Avoidable waste* is reduced by using technology to minimize the inputs required for output (i.e., by what is presently called source reduction activities). Technology provides "a politically painless means of increasing . . . productivity and getting more out of . . . material resources." *Unavoidable waste*, however, can not be reduced by technology or by careful and skilled artisans: "[It] is the inevitable result of doing this or that job, no matter how well" (Glysson, 1972, p. 13).

Anderson (1987) also defined categories of *unusable wastes* and *economic wastes*. The *unusable wastes* correspond to Glysson's *unavoidable waste*; while, the *economic wastes* are a subset of Glysson's *avoidable waste* based on criteria of profitability. Bower explored similar themes in a series of papers arising from work by Resources for the Future on residuals in the pulp and paper industry (Bower *et al.*, 1971; Bower *et al.*, 1973, Bower, 1975 and Bower 1977).

Industrial materials management certainly appears to be an area of common interest, a component of a shared world view, among environmentalists, consumers and industry. Although the topic has received much attention over the past century, the rash of case studies, of manuals on conducting waste audits, and of journal articles seems to set to rest the idea that this is "old hat." The flurry of consulting activity in the area is a further sign that more remains to be accomplished. The Ontario Resource Stewardship Model proposes to reinforce and codify this element of stewardship through the imposition of "producer levies" and specific "3Rs requirements."

**BOX 4
WHAT IS A MRF?**

The meaning of the initials MRF have become quite cloudy and individual writers should fully define their intent. In a recent article, the origin of MRF is cited as a replacement for an IPC, an Intermediate Processing Facility (Seldman, 1991, p. 98).

The US Resource Recovery Act of 1970 called for the EPA to undertake the demonstration of "large-scale recovery of municipal and urban wastes." By 1973 several vendors were reporting success with processes for "comprehensive materials recovery" yielding paper, glass, aluminum and ferrous metal streams (Jackson, 1975, p. 11). In 1979, a report by the US Office of Technology Assessment talked of Centralized Resource Recovery Systems for mixed municipal solid waste with subsets of materials recovery and energy recovery (US OTA, 1979, p. 95). Apotheker reported on the costs and achievements of mixed waste processing plants in Iowa, North Carolina and California (Apotheker, 1991-1, p. 32).

EPA, in its handbook of material recovery facilities, identified the first MRF in the United States as one in Groton, CT established in the early 1980s. EPA defined a MRF as:

a central operation where commingled and/or source separated recyclables are processed either mechanically or manually. Here, a separation and/or beneficiation of recyclables prepares them to market specifications for sale" (US EPA, 1991, p. 1-1).

The EPA study acknowledged variations from this "basic" MRF. These variations included plants which receive mixed municipal solid waste. On a further variation of this theme, *BioCycle* reported the use of the terms "clean MRF or recycling centre" and "dirty MRF" (Glenn, 1993-2). The latter generally must be permitted under a state's solid waste regulations. A "basic MRF" would not receive such waste.

The Ontario Resource Stewardship Model defined a MRF as either a plant in which curbside or depot sorted materials are prepared for shipment to market or a plant in which commingled recyclables are sorted and prepared for shipment to market (Ontario WRAC, 1992, p. 24).

Preserving Secondary Material Quality

Secondary materials, whatever their source, must compete with virgin materials on the basis of quality and price. The quality adjusted price of the secondary materials must be at least "close" to that of virgin materials. The Ontario Resource Stewardship Model attempts to achieve this balance by the use of source separation programs to yield the highest quality possible. Such an objective is consistent with a sustainable materials policy in the Stewardship Approach.

The Ontario government has made source separation¹⁸ a major component of waste management policy since the mid-1980s (McRobert, 1992, p. 2; Shrybman, 1989). Even earlier, the Ontario government started research into source separation in the 1970s and in 1981 announced a program to support source separation projects. By 1985, the program served 30 municipalities with 15 projects (Ciulini, 1986, p. 38). In 1986, a Memorandum of Understanding with the soft drink industry, establishing the Blue Box program, indicated another step on the road to significant source separation programs. This interest has continued with the recent proposals for mandatory source separation of selected Industrial-Commercial-Institutional waste streams (Ontario WRO #1, 1991, p. 20) and the extension of mandatory source separation for selected recyclables to all but the smallest Ontario municipalities (WRO #1, 1991, p. 21). The concept of source separation has been endorsed by industrial groups in Ontario through their participation in the private Ontario Multi-Materials Recycling Inc.¹⁹ (Hoffman, 1986) and the stewardship program of the Ontario Soft Drink Association (OSDA, 1991). Nationally, manufacturers have been buying into source separation through initiatives such as the Stewardship program proposed by the Grocery Products Manufacturers of Canada (GPMC, 1992). (These last two stewardship programs are discussed in the later section **Responsibility for Stewardship**).

The choice of source separation as a method of acquiring good quality secondary materials is being challenged by equipment developers who design and operate centralized sorting facilities, sometimes known as Materials Recovery Facilities (MRFs) (see Box 4). During the late 1970s such a plant was advocated as the solution for the disposal problem in the Greater Toronto Area by a consortium called Envacc Resources. Among the partners in Envacc is the firm "American Recovery Corporation." This firm's advertising in the trade magazine *Waste Age* proclaimed "SOURCE SEPARATION JUST BECAME OBSOLETE" (CUPE, 1989, p. 40).

A materials management approach to municipal waste management was quite common in the United States prior to the 1960s, when the trash compacting refuse truck was introduced (US OTA, 1992, p. 9). It appears that labour cost savings provided by the new trucks outweighed the revenue generated by the materials reclaimed and that municipal finance was the major question at issue. This

same trend was identified by Goldoftas as starting in the 1950s as source separation programs were abandoned and most cities collected mixed garbage (Goldoftas, 1987, p. 37).

Goldoftas cited also data from the New York State Legislative Commission on Solid Waste Management showing that between 1908 and 1924, 50 to 83 percent of U.S. cities separated some items for reuse.²⁰ The trend towards source separation of residential rubbish in the U.S. was started in New York City in 1896. Streets Cleaning Commissioner Waring enforced mandatory source separation by the use of police constables (Hoy and Robinson, 1979, p. 11).

The imperatives of war also have provided incentive for intensive source separation. For example, see the earlier discussion of the boulevard collection program for source separated materials operated by the Winnipeg Patriotic Salvage Corps during World War II.

Transportation and Fiscal Policy

As final elements of **Materials Conservation Policy**, transportation and fiscal policy have generated much controversy. Earlier subsections explained that virgin and secondary materials compete as inputs to production processes. In the absence of quotas on secondary materials inputs, the two types of materials compete on the basis of quality adjusted prices. In an efficient market, prices for *virgin materials* will reflect costs of exploration (if necessary), extraction, transportation, initial processing and a charge for scarcity. Again in an efficient market, prices for *secondary materials* should reflect the cost of collecting discarded products and materials, transporting to a processing facility, processing, transportation to market and a charge for scarcity. The price paid for secondary materials might be reduced by the cost of any additional processing required before the purchaser could use the material or for any reduction of yield caused by the secondary material (e.g., if 10% more secondary fibre than virgin fibre is necessary to make a tonne of paper). In both cases, the cost components would reflect both variable components and fixed components such as write-off of capital and the necessary return on capital.

Historically, the recycling industry has pointed at differing treatment of two cost elements which discriminated against secondary materials and raised their prices. First, before transportation deregulation in both Canada and the United States during the 1980s, regulatory authorities permitted lower *transportation charges* for unprocessed raw materials such as most virgin materials inputs. Secondary materials were obviously already processed, being discarded finished products, and hence did not qualify for the reduced transportation rates. Second, before tax reform during the late 1980s in both Canada and the United States, *favourable tax treatment* of investment expenditures, and

income earned, reduced the cost of capital for the virgin materials. Many of these favourable treatments were not available for secondary materials.²¹

Estimates of the impact on the use of secondary materials caused by U.S. federal tax subsidies for virgin materials are quite low. Based on a range of studies from the late 1970s and 1988, the U.S. Office of Technology Assessment reported that removing the subsidies would result in a maximum price increase for virgin materials of six percent (copper) and that the maximum increase in secondary materials utilization as a result would be one percent (aluminum) (US OTA, 1992, p. 202).

One other feature of virgin material resource extraction is important. In Canada and parts of the U.S., these materials are obtained from government owned land. There are indications that, in the past, government has not always received full value for the right to extract resources from these lands. Government has used access rights to these lands as an inducement to create economic activity in areas where there might not otherwise have been as much, or indeed any, industrial activity. Some of these incentives are being removed, but others still remain.²²

These kinds of issues are not addressed directly in the Ontario Resource Stewardship Model. Neither have they been discussed in the Ontario waste management discussion papers reviewed for this article. The Waste Caucus of the Ontario Environment Network has recommended that reforms of these types of fiscal policy be undertaken (Jackson and Wallace, 1993, p. 10).

The other area of fiscal policy change is a levy to reflect the social cost of environmental impacts and waste disposal that is not included in the price of a product. The Ontario Resource Stewardship Model has two components relating to this issue—a *levy on producers* of "products and packages usually consumed by individuals and which, after limited use, become waste" (Ontario WRAC, 1992-2, p. 22); and a system of *"generator pay" user fees* for residential secondary resource and waste management services (Ontario WRAC, 1992-2, p. 19). Details of the proposals for both the levy on producers and the generator pay user fees are discussed below under the heading **Responsibility for Stewardship**. For the moment, consider the history of levies on products as a tool to reduce waste generated.

The idea of a product levy to cover the cost of managing wastes is not new. It is an application of a long-standing suggestion in economic theory, made in 1920 by Pigou, that a "bounty" or a tax be used as a correction for a divergence between "social and private net product" (Pigou, 1962, p. 224). In this case, the net social product is less than the private net social product implying that the level of activity is excessive and a tax would be applied to reduce the level of activity. Three possible impacts can be identified—a reduction in the output of the product, a reduction in waste created by the product and a reduction in virgin materials used in the product.

North American legislative action on the topic began in the U.S. The idea was incorporated into the Solid Waste Disposal Act of 1965 (Section 205) as amended by the Resource Recovery Act (RRA) of 1970 and again in the Resource Conservation and Recovery Act (RCRA) of 1976 (Section 8002 [j]). RRA required EPA to study

. . . the necessity and method of imposing disposal or other charges on packaging, containers, vehicles, and other manufactured goods, which charges would reflect the cost of final disposal, the value of recoverable components or the item and any social costs associated with non-recycling or uncontrolled disposal of such items (US EPA 4th Report, 1977, p. 88).

EPA began work on the concept and by its Second Report to Congress in 1974 was able to conclude "that, from a conceptual and theoretical economic stand point, the product charge approach has a number of desirable incentive and feasibility features" (4th Report, 1977, p. 88).

At the same time, the EPA commissioned additional research on the issue. One such study examined the impact on the paper industry (Miedema *et al.*, 1976), another looked at packaging more generally (Bingham *et al.*, 1974). These two reports were developed at the Research Triangle Institute in North Carolina and ultimately led to the development of a Paper-Packaging-Containers (PPC) model which estimated allocative and distributive impacts of a product charge on bulk paper and packaging materials (Miedema *et al.*, 1980).

RCRA of 1976 established the "Resource Conservation Committee." The Committee was required to investigate the "appropriateness and feasibility" of several policy measures including product charges. "Economic, social and environmental consequences" were to be investigated (US OTA, 1992, 349). The Committee issued its final report in July 1979 based partially on the PPC model (Resource Conservation Committee, 1979).

The legislative proposals to institute such a product charge generated considerable discussion in the United States. For instance, industry groups commissioned their own studies. One industry sponsored study, entitled *Solid Waste Management and the Paper Industry*, found that the proposed levy of \$30 per ton, phased in over ten years, would be more successful at generating revenue than reducing waste (Franklin *et al.*, 1979, p. vi). Other studies looked at technical issues in the economics of waste management, e.g., *Recycling the Materials in Municipal Solid Waste: Estimates of the Elasticities of Secondary Material Substitution and Supply* (ICF Inc., 1979).

Miedema continued to publish in the area developing a simulation model that compared the product charge ("disposal charge"), user fees, litter taxes, and recycling subsidies. In the absence of transactions costs, the product charge was found to yield the greatest improvement in social welfare (Miedema, 1983, p. 21). In a paper to a conference sponsored by the New York Legislative Commission on Solid Waste Management, Miedema reported that the PPC model predicted an increase

in the national recycling level from a base line from 11 percent to 12 percent or 14.5 percent, depending on whether the charge was levied at \$10 or \$40 per ton. Solid waste reduction ranged from two percent to seven percent with corresponding charges (Miedema, 1985).

The issue continues to be discussed by academic economists and waste management specialists. A recent article suggested a slight variant of the Pigouvian tax "to deal with the solid waste crisis." The article argued that an excise tax be placed on goods because their private net benefit exceeds their social net benefit and a subsidy ("a bounty") be provided to households that recycle because the social net benefit of recycling exceeds the private net benefit. Interestingly, while the authors acknowledged their debt to Professor Pigou, no reference was made to the substantial work done on the issue by Miedema and others since 1970 (Schellberg and Atri, 1991, p. 13). Another recent article, in the recycling trade literature, discussed a number of initiatives for "Advance Disposal Fees (ADFs)," generally in the form of excise taxes, considered by American states for imposition on hard-to-dispose-of materials (Ludwig and Jones, 1992, p. 94).

Some interesting estimates of the value of product levies, set to reflect the size of external environmental costs of common products, are beginning to emerge from work done by the Tellus Institute. The studies examined New Jersey data (for a consortium of agencies) and California data (for the California Integrated Waste Management Board). Schall (1992) estimated that each ton of waste prevented would yield, on average, about \$170 of environmental protection benefit. About two percent of this amount from avoiding environmental impacts caused by the waste management system and 98 percent from avoidance of impacts created by the materials production system (Schall, 1992, pp. 66-69). Similarly Schall estimated the environmental benefit of recycling a ton of material to be about \$120/ton—83 percent as a production credit and the balance as avoided environmental damage of the disposal system (Schall, 1992, p. 62). (Note the significance of the benefits arising from Materials Conservation).

Breslow also reported on this work and presented a comparison of the external costs of various products from virgin materials and secondary materials. He also examined the impact on producers if taxes were applied to inputs equal to the value of the externalities. Material input prices would rise by over 25 percent for products such as food products, printing, household appliances, motor vehicles and restaurant services (Breslow, 1993, p. 82).

Several states and provinces have beverage container levies which may be labelled deposit/refund systems but which are closer to product charges. For instance, the California redemption law, known as A.B. 2020, requires bottlers and wholesalers to pay into a state-held redemption trust fund. The mandatory payment was increased in 1990 because recycling targets were

not met (Franklin, 1989, A-2). In Florida, a deposit-fee system has been introduced for all types of containers, not just beverage containers. The fee will increase if specific recycling targets are not met (US OTA, 1992, p. 320). In New Brunswick, an environmental fee is levied on selected recyclable beverage containers (NB, 1992, p. 2). In Manitoba, non-refillable glass liquor and beer bottles are subject to a ten cent environmental tax for a 750 ml or more bottle (Environment Canada, 1992, p. 57).

Also in Manitoba, the Waste Reduction and Prevention legislation provided for the imposition of pre-disposition levies on various products sold in the province (Manitoba, S.M. 1989-90 C. 60, p. 6). The Manitoba Recycling Action Committee recommended predisposal levies be applied to products only if the brand-owner failed to meet agreed upon waste reduction targets (Manitoba RAC, 1990, p. 31).

Tire levies also have been established in several states and provinces. For instance Florida and Wisconsin have adopted fees (US OTA, 1989, p. 339), as have British Columbia (\$3 per tire), Ontario (\$5 per tire) and Prince Edward Island (\$2 per tire) (Environment Canada, 1992, p. 57).

The Canadian federal government "Green Plan" discussion paper reviewing economic instruments for environmental protection also considers product charges as a method reducing of municipal solid waste. It concludes with the assessment:

If, for instance, the goal is to encourage consumers to generate less solid waste, a product charge imposed at time of sale would serve this goal by encouraging consumers to buy less of the products in question. If the goal is to encourage consumers to use proper disposal practices for certain products, a more effective approach may be to provide consumers with full or partial rebate when the proper method of disposal is used. . . . In the case of solid waste management, for example, an appropriate structure for a product tax might be one that distinguishes between products made of new materials, recycled materials and various combinations of new and recycled materials (Environment Canada, 1992, p. 58).

The federal government's reluctance to enter into a general tax on products and materials is understandable given the recent controversy over the replacement of the manufacturer's sales tax with the Goods and Services Tax. They are much more "upbeat" about user charges for municipal waste management programs and deposit-refund schemes (Environment Canada, 1992, p. 46).

RESPONSIBILITY FOR STEWARDSHIP

As outlined above, the Ontario Resource Stewardship Model incorporated two earlier models—the Organic Waste Action Plan, and the Shared Model for dry recyclables. Each of the earlier models had relevance to both residential and Industrial-Commercial-Institutional (ICI) sectors. The

focus of responsibility for stewardship changed from model to model and sector to sector. The stakeholders to be held responsible included producers (businesses manufacturing or selling products), generators (both residential and ICI), municipalities and the provincial government. (The federal government, while not given a specific role, was lurking in the background).

Resource Stewardship was defined in the Ontario Resource Stewardship Model as: "The acceptance of responsibility for resource and energy conservation, and secondary resource management by those who benefit from the use of resources" (Ontario WRAC, 1992-2, p. H-4). The Model assigned both financial and functional/behavioral responsibilities to stakeholders.

In order to assign *financial* responsibility, the Ontario Resource Stewardship Model advocated a system of user-pay charges for the stakeholders that use and benefit from the system: producers and generators. This method was seen as consistent with a system in which "each and every stakeholder accepts responsibility for resource conservation and environmental sustainability."

Producers would pay a levy, "the variable user charge" (VUC), on their products scaled to reflect the true costs the product creates for the secondary resources management and waste management system. For instance in the case of packaged food, the lowest charge would apply to reusable packaging; a middle level with a range of charges would be levied for recyclable packaging, with the actual cost scaled to cover the actual cost of collection, processing and recycling the packaging material; and the highest charge would apply to packaging destined for disposal. To prevent discrimination against international and interprovincial trade, exemptions would be provided for products exported from Ontario and the charges would be levied on products imported into Ontario. The Variable Unit Charge would be incorporated into the price of the product to internalize any external costs of management of secondary materials and wastes (Ontario WRAC, 1992-2, p.24). The "Pigouvian nature" of this levy is clear.

Generators (both residential and ICI) would pay a variable user fee for secondary resource management (both dry recyclables and organic) and for waste management services to dispose of any residual materials. (Ontario WRAC, 1992-2, iii).

To further discussion of financial responsibility, the Ontario Ministry of Environment and Energy prepared a 1993 position paper, outlining the financial responsibility for the systems, to serve as basis for discussions by a group called the Municipal Share Committee. The Canadian Institute for Environmental Law and Policy together with the Canadian Environmental Law Association have called for the full cost of secondary resource management to be paid by producers through levies (CIELP, 1993, p. 230).

TABLE 2
TASKS TO BE DONE BY INDUSTRY FUNDING ORGANIZATIONS

Negotiate with the Provincial Government:

- overall targets to ensure accountability in closing the product/package production and recovery "loop"
- guidelines for determining the Variable User Charges to be applied against each member
- the nature of data monitoring and reporting systems
- guidelines for conducting negotiations with "upper-tier municipalities"²³

Implement on Behalf of Producers:

- collect VUCs
- operate MRFs
- market secondary materials
- maintain relations with municipalities

TABLE 3
REQUIREMENTS OF PRODUCERS FOR MEMBERSHIP IN
SECTOR ORGANIZATIONS

- develop a Waste Reduction Workplan on designated products and packages that outlines the firm's efforts to meeting its share of 3Rs targets agreed to between the Sector Organization and the government
- implement the Workplan and achieve the targets set out in the plan according to the agreed upon timetable
- provide data to the Sector Organization on its reduction efforts
- execute any other specific actions required by the firm under the agreement with the government (Ontario WRAC, 1992-2, p. 36).

Functionally, there is a similar sharing of responsibilities. Producers would finance a system of Material Recovery Facilities (MRFs) for processing and marketing dry recyclables and actively promote markets for secondary materials. Generators (both residential and non-residential ICI generators) would separate dry recyclables and organic wastes from any other residual waste materials. Municipalities would operate, directly or via contractors, programs to collect dry recyclable materials, organic waste and residual refuse from the residential sector. Dry recyclables would be tipped at producer-financed-MRFs, organic materials and refuse respectively at municipally-financed-composting facilities and landfills. Waste management contractors would provide the same services for the Industrial-Commercial-Institutional sector. The provincial government

. . . serves a leadership role, oversees the undertaking, monitoring, and enforcing of waste management programs, and provides various support services. It: (1) ensures that the Model is implemented, (2) supervises its operation and (3) holds various parties accountable (Ontario WRAC, 1992-2, p. 11).

The following subsections review in detail the allocation of responsibility for Stewardship to various actors: producers, generators, municipalities, provinces and the federal government.

Producers

The requirement for producers to exercise stewardship, by participating in the Industry Funding Organization and the appropriate Sector Organizations, was well established in the Ontario Resource Stewardship Model. The extent of the responsibility attached to such membership was not so clear. The responsibility would be determined by two sets of negotiations between the Ontario government and each of the IFO and the SO leading to a Memorandum Of Understanding with each group. There would be a time limitation for negotiation of these Memoranda.

The Industry Funding Organization would set out the "rules of the game" for meeting Stewardship Responsibilities. These functions are outlined in Table 2. By joining, the producer agrees to pay to the Industry Organization an administration fee and the Variable User Charge described above.

With the Sector Organization, the negotiation would include: specific source reduction, reuse, and recycling (3Rs) targets and could require life-cycle analyses to be undertaken (Ontario WRAC, 1992-2, p. 33). The member producer would be required to undertake the activities outlined in Table 3. It is the Waste Reduction Workplan, identified in Table 3, that actually would establish the producer's stewardship responsibilities.

The concept of firms taking such active responsibility for product stewardship has been developed over a number of years, particularly in the management of hazardous wastes (OECD, 1975;

Bringer and Benforado, 1989). In a more general context, the Science Council of Canada recommended that:

industrial institutions incorporate the concepts of durability and recycling in process and product design and, in cooperation with all levels of government, establish effective programs for the recycling of municipal, industrial and agricultural wastes (SCC, 1973, p. 38).

Glysson also identified the need for producer stewardship when he says that the solid waste disposal problem "is composed of thousands of materials questions, manufacturing and product design questions (short and long term), [and questions about] sales strategies" (Glysson, 1972, p. 1).

More recently, a 1989 proposal for a U.S. national municipal solid waste policy suggested that both a management component and a prevention component were necessary. *The prevention element would cover activities by manufacturers before they produced a good and by consumers before they purchase a good.* The goal would be to encourage choice of goods which are durable and contain non-toxic elements (US OTA, 1992, p. 7) (emphasis added). The proposal suggested also "rate of progress fees on manufacturers" to provide incentives to firms or industries to achieve Congressionally mandated recycling target goals by a specified date (US OTA, 1992, p. 32). The deposit-fee system in Florida was named as an example of this legislation. (See the discussion, above, of product levies).

In Manitoba, the provincial government accepted a recommendation of the Recycling Action Committee that "distributor responsibility" agreements²⁴ for the achievement of waste minimization targets be negotiated between the provincial government and producers. The concepts of the Industry Funding Organization and the Sector Organization are not as well defined in the Manitoba Waste Minimization Strategy as they are in the Ontario Resource Stewardship Model. Manitoba, however, did foresee the possibility of distributors using industry-wide umbrella organizations to meet their targets.²⁵ The Manitoba Strategy also incorporated: strong incentives for distributors to file action plans, penalties if targets were not met, and the possibility of municipalities operating collection programs for recyclables under contract to the distributors (Manitoba RAC, 1990; Manitoba Environment, 1991).

Fenton has extended the Manitoba Strategy by suggesting a stewardship-management model. The waste stewardship strategy required of distributors and brand-owners would prevent waste via the 4Rs waste management hierarchy. The waste management strategy for municipalities would deal only with waste that cannot be reduced, reused, recycled or recovered through the waste stewardship strategy (Fenton, 1993, p. 26).

Voluntary product levies are a component of several Stewardship proposals put forth by industry. For instance, the Packaging Stewardship model proposed, in 1992, by the Grocery Products

Manufacturers of Canada also calls for industry members subscribing to the Stewardship model to join and pay levies to a national IFO.²⁶ Payments would be based on the volume of packaging used and at a later stage be related "to the actual cost of managing the post-consumer packages recovered" (GPMC, 1992, p. 2). To encourage use of post-consumer secondary materials in consumer packaging, members of the national IFO would be eligible for rebates based on the secondary materials used. The national IFO also would make direct investments into research and development related to secondary materials and market development for post-consumer packaging materials. Provision would be made for funds to flow to provincial IFOs to operate materials recovery facilities.

As another example of these voluntary levies, the Ontario Soft Drink Association (OSDA) suggested a Pigouvian bounty to municipalities and Industrial-Commercial-Institutional sector organizations to encourage recycling of soft drink containers. The bounty would be funded by the industry and would be a method of internalizing the costs of recycling into the product price (OSDA, 1991).

A further example was provided by the Canadian Petroleum Products Institute which as part of an *used oil action plan* recommended that governments impose a "user pay tax on over the counter sales of lube oil to assist government in paying for used oil collection from rural and do-it-yourself lube oil users" (CPPI, 1990). The "Action Plan" was adopted in Ontario on October 1, 1992 following negotiation with the Ministry of Environment. Retailers of oil to the do-it-yourself market will provide collection depots (Recycling Update, 1993-1, p. 8).

Although the "voluntary product levies" contained in these stewardship models are important, they are only one necessary element of a broader Stewardship Approach carefully developed over time to be part of a materials policy as discussed in earlier sections. The time dimension is critical; the period should be short enough to *accelerate* change, including development of markets for secondary materials, and long enough to permit the markets *actually* to develop. This fact is demonstrated by the example of the German Packaging Ordinance and the resulting "Green Spot Fee" system (See Box 5) which resulted in substantial surpluses of collected materials. The export of these surpluses to other members of the European Union resulted in complaints of unfair trading practices and disrupted existing markets for secondary materials in Britain and France. In this sense, the voluntary levy is no different from any other instrument which over-emphasizes collection relative to creating markets for secondary materials. The levy may have reduced the amount of waste landfilled in Germany, but it is not clear that net conservation of either material or energy resources occurred.

The difficulties with the German Ordinance might have been avoided had the German government adopted the kind of negotiated compliance proposed in the Ontario Resource Stewardship

**BOX 5
THE GERMAN PACKAGING ORDINANCE**

The Avoidance of Refuse Ordinance of 1991 made German distributors responsible for collecting used packaging outside of the normal refuse collection system. Secondary packaging was to be removed prior to material leaving the store and convenient collection depots for used were to be established by distributors.

The above requirements are waived for products bearing the "Green Spot" signifying that the distributor has paid a levy to the *Duales System Deutschland* (DSD). Levies were set on the basis of volumetric capacity of the package. Most distributors have opted for the Green Spot program.

The 1991 Ordinance also set targets to which even users of the Green Spot are subject. Individual targets are set for collection and recycling. The *effective* recycling target is the product of the individual targets (e.g., glass in 1993 42%). The targets are:

MATERIAL	JAN. 1993 TARGET		JULY 1995 TARGET	
	COLLECT	RECYCLE	COLLECT	RECYCLE
Glass	60%	70%	80%	90%
Tinplate	40%	65%	80%	90%
Aluminum	30%	60%	80%	90%
Paper&Board	30%	60%	80%	80%
Plastics	30%	30%	80%	80%
Composites	20%	30%	80%	80%

Incineration with energy recovery does not count toward the achievement of the *effective* recycling target (Perchard 1992, Appendix 1; Hitchins, 1993, pp. 32-33).

In the short run, the targets have proved too ambitious, and the collection program too successful, resulting in an oversupply in German secondary materials markets. DSD has paid the shipping cost to foreign markets and is even reported to have paid British processors to take delivery of materials (Cooper, 1993, p. 48). The initial levies set by DSD have been insufficient to cover all of the costs and the organization is facing bankruptcy (Genillard, 1993).

As in Ontario, Germans have long viewed incineration of household waste as environmentally unacceptable. Following the problems caused by the 1991 Ordinance, the policy towards incineration is under review (Genillard, 1993).

Model (Ontario WRAC, 1992-2, p. F-9). Such negotiated compliance would facilitate integration of targets and necessary investment in the manner appropriate to a materials policy consistent with the Stewardship Approach.

Producers exercising their Resource Stewardship responsibilities are very important to the achievement of the goal of sustainable development, to the achievement of the new world view. Stewardship changes, fundamentally, the way producers look at their materials, products and waste management activities. It is revolutionary yet well established in some corners of the corporate world. Successful implementation of the Ontario Resource Stewardship Model would move the concept to the very centre of the North American business stage. (It remains to be seen if the various on-going implementation efforts will indeed propel the concept forward to that central position).

Generators

As mentioned above, waste generators under the Ontario Resource Stewardship Model also have functional and financial responsibility. Residential generators (including municipalities as the agents of residential generators) have the *functional* responsibility to source separate dry recyclables and organic wastes. Municipalities would collect and deliver the dry recyclables to the industry-sponsored Materials Recovery Facilities and the organics to composting facilities funded by the municipality. Industry-Commercial-Institutional (ICI) generators working through waste management contractors would continue to fulfil the same responsibilities for source separation and delivery of designated materials to appropriate facilities.²⁷

ICI generators continue to pay for secondary material and waste management services through fees charged by contractors as their *financial* responsibility. Under the Ontario Resource Stewardship Model, residential generators also would pay for these services via user fees. The user fee for waste management services would be higher than the fee for secondary materials services. While the Ontario Model did not identify a particular generator pay system, several different varieties have been reviewed in the literature:

- a fixed fee for pick-up of a container rented from the waste collection agency,
- variations on this include rented containers of different volumes and fees scaled accordingly,
- weight based systems with a rented container,
- volume-based dedicated bag systems with the bag bearing the logo of the collection agency,
- tag/sticker systems where every container or bag must carry the appropriate tag or sticker.

Much of the literature concerns generator pay systems for waste management only. A few examples of a generator fee charged for recycling services are also available in the literature.

Canadian municipalities in general have not had the authority to charge for waste disposal services on any basis other than a property tax levy. The Ontario government has announced changes to the Ontario Municipal Act to provide such powers (*Recycling Update*, 1993-2, p. 4), following release of a discussion paper (Ontario Municipal Affairs, 1992, p. 36) and requests from Kingston, Waterloo and Peterborough for such powers. Despite the lack of general authority to impose volumetric based user fees for waste, several Ontario municipalities have done so: Town of Gananoque, Township of Westmeath, Township of McNab, West Garafraxa Township and Town of Coburg (Ontario WRAC, 1992-2, p. C-7; and *Recycling Update*, 1993-1, p. 13).

Elsewhere in Canada, the Manitoba Recycling Action Committee recommended that municipalities in that province be given the authority to charge for waste collection and disposal on a weight or volumetric basis (Manitoba RAC, 1990, p. 46). The Environmental Council of Alberta (ECA) recommended in 1987 that Alberta municipalities be given the power to implement such user fees (ECA, 1987, p. 25). In British Columbia, the Municipal Solid Waste Task Force recommended a provincial review of municipal solid waste user charge options and encouragement to local governments to implement solid waste user fees (BC Task Force, 1989, p. 135).

In the United States, two different user-pay scenarios are evident. A number of American municipalities do not provide residential refuse collection services. Rather, they require residential owners to contract with private waste management companies to obtain the service. Service may be on the basis of a exclusive franchise operation or an oligopolistic "competitive" market. In 1975, a survey of municipal practices for providing residential mixed refuse collection in 2060 U.S. municipalities showed that more than 41 percent had householders contracting directly with a private service provider (Savas, 1977, p. 51). This included about 15 percent of the cities with population over 100,000 (Savas, 1977, p. 56). All of these arrangements were on a user-fee basis but more than 75 percent of these were on a flat fee rather than a variable fee. In communities where the municipality provided the service, only 37 percent were financed on a user-fee basis. Of that group about 90 percent were charged a flat fee (Savas, 1977, p. 82).

In the interim, the number of privately contracted providers has declined and more municipalities are charging a variable user fee. A recent report in the trade literature stated that in 1993 there were more than 1000 variable rate programs fees operating across North America (Skumatz and Zack, 1993, p. 68). Seattle probably has the best known and most successful system in North America. It has a range of container sizes with a fee varying by volume (Seattle, 1989, p.

111) and have experimented with a weight based fee (Skumatz, 1991, p.64). But variable fees for waste management, including weight based fees, are attracting interest elsewhere in the US. The EPA put out a handbook on variable rate structures for municipal officials (US EPA, 1990) and a number of states have passed legislation concerning variable rate pricing of trash collection. Three states have made it mandatory and five more states actively promote the implementation of such programs (Skumatz and Zach, 1992, p. 67). The Ontario Waste Reduction Advisory Committee provided examples of bag based systems from Perkasio, PA, Carlisle, PA, Duluth, GA, Grand Rapids, MI and Ithaca, NY (Ontario WRAC, 1992-2, p. C-10). In an earlier discussion paper for the Ontario Recycling Advisory Committee, Resource Integration Systems Ltd. discussed six additional examples of U.S. waste management fees, including one example of a fee for recycling services (RIS, 1990).

A recent academic study from the U.S. estimates the effectiveness of user-pay systems for residential and commercial waste generators. The statistical analysis is set in a context of a consumer utility maximization model for residential generators and a profit maximization model for commercial generators. Although the available data set causes some problems, the study concludes that setting a user fee of \$1.00 (US\$) per 120 litre pail would reduce residential waste by 15 percent. The cost of residential collection and disposal is assumed to be removed from the tax base at the time the fee is imposed (Jenkins, 1993, p. 128).

As the reader can interpret from the amount of activity in the area of variable fee pricing, the Ontario Resource Stewardship Model is hardly breaking new ground in advocating this method of achieving generator responsibility and stewardship. The proposals might be interpreted by some citizens, however, as the "government charging for a service which was previously free," or "the government charging twice for the same service." These arguments against variable rate pricing of waste services are themselves hardly new. Many municipalities will have heard them before on the occasion of installing water meters and volumetric based water rates.

Municipalities

The Ontario Resource Stewardship Model identified that municipalities, as the agents of residential generators, influence the participation of individuals in recycling and composting programs and control how the residential generators financially contribute to the program. As a result, municipalities were seen as responsible for administering (operating or contracting for) a secondary resource management system and a waste management system for residential generators. The system would include dry recyclables, wet organics and waste requiring disposal (Ontario WRAC, 1992-2, p. 11).

Under these proposals upper-tier municipalities would negotiate agreements with Industry Funding Organizations to cover:

- location, ownership and management of Material Recovery Facilities (MRFs),
- types of collection systems to be used and relevant cost differentials,
- the quality of materials to be accepted at the MRF (Ontario WRAC, 1992-2, p. 34).

If the IFO-operated-MRF were to request greater separation of materials at source than the agreed upon standard, negotiations would be required to establish per-tonne payment from the MRF to the municipality to compensate for the extra collection cost involved.

The municipality would have the option to retain responsibility for processing and marketing all designated secondary materials they collect, but in this instance the municipality would forego any legal right to financial assistance for the operation of their MRF. Under this arrangement, a municipality would have the authority to negotiate any arrangements it wanted with industry (Ontario WRAC, 1992-2, p. 27).

When discussing the negotiations between the Industry Funding Organizations and the upper-tier municipalities, the phrase "relevant cost differentials" presumably means any cost premium of operating the dry recyclables collection system over simply operating a waste management system. The possibility of a per-tonne payment to municipalities (and private sector generators) is provided for in a chart showing the "flow of funding in the shared approach (dry stream only)" (Ontario WRAC, 1992-2, p. 28).

The possibility of the Variable User Charge (VUC) being used to subsidize municipal costs for hard-to-dispose-of products or materials is not hinted at in the Model presented by the Ontario Advisory Committee. Yet, the proposed contract between the firm and the Industry Funding Organization would require a "payment to the IFO of a VUC on each product and package set at a level that reflects the relative waste management impacts within the system" (Ontario WRAC, 1992-2, p. 36). This issue presumably would be a topic for the negotiations between the province and the IFO. Certainly municipalities would welcome such payments.

The model of municipal responsibility proposed by The Advisory Committee is innovative. A few variations on the theme have been developed elsewhere. In outlining the waste stewardship-management model based on the work of the Manitoba Recycling Action Committee, Fenton suggests that:

. . . municipalities . . . manage and operate on behalf of a product distributor, any recycling programmes that the private company wished to include in its waste

stewardship action plan. In return, the municipality would receive an agreed-upon service fee. The company would not be relieved of its responsibility to meet the reduction targets although the municipality might be contractually responsible for delivering certain components of the programme. If for its own reasons, the municipality chose to implement a different, more expensive programme the municipality would pay the incremental cost (Fenton, 1993, p. 30).

Municipalities also would receive industry financial assistance in meeting recycling objectives under the GPMC Packaging Stewardship model. The Industry Funding Organization would make "top-up" payments to municipal programs for collecting packaging materials. The payments would equal the difference between "efficient collection and sorting costs" and revenues from the sale of materials. Top-up payments would be further reduced by cost avoidance credits and any additional recycling grants (GPMC, 1992, p.4).

Similarly the waste minimization action plan adopted by the Ontario Soft Drink Association in 1991 committed the Ontario soft drink industry "to internalization of waste management costs so they are not paid for through general tax revenues" (OSDA, 1991, p. 1). The Association also committed "to provide operating cost support to municipalities, where required, to ensure that the costs of recovering soft drink containers through municipal recycling programs are met by the soft drink industry" (OSDA, 1991, p. 6). The role of an IFO to provide support to municipalities is not clear in this model. OSDA members were instrumental in setting up the OMMRI program in Ontario (see Note 14) and the Action Plan commits members to "continued support for the expansion of Blue Box collection systems to the greatest extent possible throughout the province, through OMMRI: Corporations in Support of Recycling" (OSDA, 1991, p. 6).

A more typical approach to municipal responsibility is to focus on the important role for the municipality meeting the waste reduction goals of the higher level of government. For instance, the National Round Table on the Environment and the Economy noted the need for new waste management policies at both federal and provincial level but identified municipalities as carrying the largest share of the responsibilities. "Municipal decision-makers will be called upon to develop new local waste management strategies that divert large quantities of waste from local or regional landfills" (National Round Table, 1991, p. 1). And the Ontario Ministry of Environment identified municipalities as a principal "final repository" for waste and gave them "significant responsibility for contributing to the achievement of the Provincial waste diversion targets" (Ontario WRO #2, 1991, p. 3). This focus on municipalities bearing "significant responsibility" for achieving the provincial recycling goal has been evident in Ontario where, since 1980, the Environmental Assessment Act requires municipalities seeking to site new waste facilities to demonstrate that all reasonable alternatives to disposal have

been considered and feasible diversion considered in the planning (AMO, 1989, p. 2). While Ontario identifies a primary role of municipalities, it has not imposed penalties or withheld grants for non-achievement of goals. It recognized that waste reduction targets of 25 percent by 1992 and 50 percent by 2000 "will not likely be achieved uniformly throughout Ontario. . . . Ultimately, each municipality should assess its situation and maximize its contribution to the provincial targets" (WRO #2, 1992, p. 4).

Some U.S. jurisdictions have been more strict in holding municipalities responsible for the achievement of the targets. For instance, Pennsylvania, Florida and New Jersey can withhold state funds to municipalities if they do not achieve recycling goals. Pennsylvania can impose civil penalties if goals are not achieved (Franklin, 1989, p. 41).

A number of U.S. states have established government owned and operated, state-wide waste utilities to own and operate or contract for, waste disposal facilities, MRFs and energy recovery facilities. For instance, the Connecticut Resources Recovery Authority operates intermediate processing centres (MRFs) and has an energy recovery program. Communities wishing to join the energy recovery program must first launch a local recycling collection program (Franklin, 1989, p. A-4). Delaware has a state solid waste authority which operates the "Recycle Delaware" program in the state. Recycle Delaware operates 100 drop-off locations and a mixed waste sorting plant. Delaware also has a beverage container deposit law (Franklin, 1989, p. A-6).

Again the Ontario Resource Stewardship Model appears to present an approach which is consistent with ideas and policies proposed and adopted elsewhere. The proposals provide a manageable way to address the problem of integrating a traditional area of municipal service and the more recent concept of corporate stewardship.

Provincial Government

The outline of the role of the Ontario Government is inherent in the preceding discussion and will not be repeated here. In summary, the elements of the role are:

- to enshrine the Ontario Resource Stewardship Model, or some preferred variation, in regulations
- to provide any necessary new powers to municipalities
- to negotiate the Memoranda of Understanding with the Industry Funding Organizations and the Sector Organizations
- to implement regulations to assure a "level playing field," and
- to ensure that all agreements involving the Model are kept.

Federal Government

As mentioned above, the federal government has no direct role in the implementation of the Resource Stewardship Model for Ontario. Solid waste management and environmental protection are provincial responsibilities except where federal responsibilities for fisheries, navigable waters and trans-boundary movements are concerned.

The federal government will influence the success of the Ontario Resource Stewardship Model, largely through the operation of the National Packaging Protocol, the EcoLogo labelling system, and the transportation and fiscal policies. Because the last two activities have already been discussed above, this section will focus on the first two areas.

Under the National Packaging Protocol, the federal government was given specific responsibilities:

- . . . in consultation with a multi-stakeholder group, . . . undertake the development of methodologies and guidelines to be used in conducting environmental profiles of packaging, allowing users to compare packaging choices. . .
- . . . in consultation with industry and the multi-stakeholder group establish a "Code of Preferred Canadian Packaging Practices" . . . [giving] consideration to the following hierarchy: No packaging, Minimal packaging, Reusable packaging, Recyclable packaging and Packaging containing recycled material . . .
- . . . [in consultation with the multi-stakeholder group develop] national minimum content standards . . . for the inclusion of secondary/post-consumer materials in packaging, recognizing health, safety, packaging product performance requirements and regional limitations . . .
- . . . act as liaison with other countries to promote the policies contained within [the] Protocol in relation to international trade (CCME, 1990).

The EcoLogo program, officially known as the Environmental Choice program, was announced in June of 1988. It involves manufacturers paying a certification fee to have their product assessed relative to a predetermined environmental standard. While the certification is in effect, the brand owner will pay an annual licensing fee of from \$1500 to \$5000, depending on sales revenue, to be able to use the EcoLogo. Certification is handled by the Canadian Standards Association under contract to Environment Canada. The whole process is overseen by a 16-person independent board.

TABLE 4
PROPOSED NATIONAL ACTIVITIES FOR
A NATIONAL RECYCLING FOUNDATION IN THE UNITED STATES

- define national recycling goals as a percentage of total waste stream and targets for specific targets and materials
- develop and promote a national philosophy and perspective on recycling, recognizing the need for cradle-to-grave responsibility and champion fairness in burdens and benefits
- create a green product certification program such as Canada's eco-logo
- establish a standard coding system for materials
- recommend product design for ease of recycling
- identify and outlaw products or packages that are "environmentally unacceptable" under any circumstances
- institute a national container deposit law
- fund research projects in areas of waste reduction and biodegradable plastics
- implement incentives and penalties to stimulate recycling
- create markets for recycled products through procurement incentives for business and requirements for government
- design educational programs.

Source: Lodge and Rayport, 1991, p. 139.

Products certified include: re-refined oil, cloth diapers, paper made from secondary fibres and products made from recycled plastic (Watson, 1991, p. 54).

It is useful to look at the role of the U.S. federal government in developing a Stewardship Approach in that country. In fact this role already has been highlighted throughout this Review. The Congress, through legislation such as the Resource Conservation and Recovery Act of 1976, the Resource Recovery Act of 1970 and the Solid Waste Disposal Act of 1965, has played a high profile role in waste management. Under these legislative mandates, various agencies have made contributions: the U.S. Public Health Service in the early years, the U.S. Environmental Protection Agency in later years (US EPA, 1988-1; 1988-2; 1988-3). The Congressional Office of Technology Assessment has issued two independent reviews of solid waste policy (US OTA, 1992; US OTA, 1979).

The U.S. federal agencies and a number of private commentators have discussed the need for "a national waste management agenda." A 1991 proposal called for the establishment of a national recycling foundation in the U.S., featuring both a national and a regional orientation (Lodge and Rayport, 1991, p. 139) With its national orientation, the foundation would undertake a range of activities outlined in Table 4.

Many of the tasks in Table 4 sound familiar! Most of them will await the reauthorization of the Resource Conservation and Recovery Act which has been before Congress for some time.

Responsibility for Stewardship, as discussed under this subheading, is the force that holds the whole sustainable development ethic together—whether the focal point is waste management or endangered species. It is the keystone to the Ontario Model and the missing link in many of the other attempts to reduce waste and divert from the landfill. The key contribution of the Ontario Model is the design it provides for distributing and balancing the various levels of stewardship responsibility.

THE WAY AHEAD

The Stewardship Approach has been proposed as a method of getting at the root causes of our solid waste problem and as a way of building towards a sustainable society. The elements of the Stewardship Approach are not new, they have been explored and debated in the past. What is relatively new are the pronouncements by industry that they are ready to take appropriate stewardship responsibility for their products and the resulting wastes. The Ontario Resource Stewardship Model and the other examples of industry stewardship declarations outlined in this Review set the bounds for the way ahead.

The path will not be clear and smooth, however. Not all industry groups were represented on the Ontario Waste Reduction Advisory Committee, and although wide consultations were held over several years, not all industry groups have yet bought in to the concept. Even the fact that the GPMC Packaging Stewardship Model has been reformulated as a more broadly based Canadian Industry Packaging Stewardship Initiative does not guarantee success. The discussions under way to implement the CIPSI model in provinces such as Ontario, Manitoba and British Columbia will be difficult and time consuming (*PAC Bulletin*, 1993, p. 1; Sinclair and Koroluk, 1993, p. 74; RCO UPDATE, December, 1993 p. 1).

A major barrier to implementing far reaching ideas, such as the Stewardship Approach (and sustainable development in general), has been our reluctance to adopt different economic incentives that would change behaviour with respect to resource exploitation, consumption and use. Although such changes could bring significant social benefit, many individuals perceived no specific private net benefit. As a result, government was lobbied by rent-seekers to ignore isolated calls for new incentives. If pressure for change became too great, incremental change was made in areas where interest groups had well established positions and little real change occurred (van Kooten, 1993, p. 175). There is a substantial risk of both private and public sector rent-seekers deflecting the momentum away from fundamental change and toward cosmetic changes during the waste stewardship negotiations.

Examples of rent-seekers trying to avoid responsibility for solid waste are many. Some will say that the original OMMRI program in 1986 was such an example (Scanlan, 1991). Similarly efforts to implement user-pay refuse collection systems in Canada have met with serious political resistance—for example in Toronto, Ottawa, (RIS, 1990, Appendix) and Peterborough (Ontario WRAC, 1992-2, p. C-8). The challenge to change comes not only from vested interests:

As history has demonstrated so often, nothing is more difficult than to maintain the driving force of change. The enemy of revolution is not just active opposition, for that may fan the flames of revolutionary purpose; it is inertia, indifference and the diversions and distractions of every day life (Heilbroner, 1991, p. 26).

Thompson's Rubbish Theory has a further important lesson for the way ahead. Just as some objects can become durable and valuable beyond measure while others can become rubbish and lie in "timeless limbo," so can ideas and behaviours fall into one or other of the categories. The idea of resource conservation seems not yet to have achieved durability. On several occasions—during crisis such as wars, periods of high energy and materials prices, and shortages of landfill space—the idea of resource, material and energy conservation as a principle of behaviour has come to the fore. (In one

case, achieving the status of the moral equivalent of war). After the crisis, the principle seemed to lose all currency and became invisible again.

The present interest in the Stewardship Approach indicates we have yet another chance to throw off the blinders about rubbish and make the idea of resource conservation durable. Our prime task on the way ahead is to maintain the focus on the principle of resource conservation sufficiently long to get consensus on the details of the sharing of responsibility for waste minimization.

NOTES

1. The first statement was made by George E. Waring, Jr., Commissioner of Street Cleaning, New York City, in 1895 (Hoy and Robinson, 1979, p. 15). The second statement was made by Imogene B. Oakley, in *The Ladies Home Journal*, Nov. 1919 (Hoy & Robinson, 1979, p. 15). The third is from the mid-1970s (Jackson, 1975, p. 1). The fourth and fifth are from the end of the 1980s in the United States (US EPA, 1989, p. 3) and Canada (CCREM, 1989, p. 2). The last comment comes from press coverage of the announcement of the location of the three new landfill sites for the Greater Toronto Area (Tobin, 1993).
2. In fact, waste management problems have existed for centuries outside of North America and date back to "the establishment of permanent agricultural societies during the neolithic revolution" (Brown, 1993-1, p. 6). In examining the history of waste management outside North America, Brown cites several earlier studies: Mumford (1961), Melosi (1973, 1980), Priestly (1968), Wilson (1977).
3. The literature on this topic is very large. See, for example: Argyle (1987), Brown (1993), Brown and Morgan (1993), Chancellor (1989), Durning (1992), Goldoftas (1987), Jackson and Wallace (1993), Kirkland (1973).
4. The fact that world views are themselves dynamic and likely to change in some way over a century is acknowledged. If anything, the high consumption world view has increased in power over the period.
5. All of the models in Table 1 are drawn from North American experience. Similar models are under debate in countries of the European Union—particularly in Germany, France, Belgium and most recently in the United Kingdom. At the time of writing, the author did not have access to adequate information on the European models to permit their complete incorporation in to this Review. The German Model (See Box 5) will be mentioned briefly to illustrate specific features of the North American situation.
6. For instance, the GPMC Packaging Stewardship Model has been renamed the Canadian Industry Packaging Stewardship Initiative to reflect a broader mandate and business support (French, 1993, p. B21).
7. Other major landfill controversies have developed in Montreal and Edmonton. In Montreal, the focus is on the "Miron site," a former cement quarry, which has been used as a landfill for over 20 years. There are complaints about harmful environmental emissions from the location; although the Montreal Urban Community is said to have invested substantial sums in leachate collection and treatment and methane collection (*Montreal Gazette*, 1993, 1992, 1991; *Toronto Star*, 1991). In Edmonton, the City faced a landfill capacity crisis in the late 1980s. This led to the development of an aggressive recycling and waste diversion program (Edmonton, 1991).
8. The delays in landfill siting occasioned by the procedures under the Environmental Assessment Act have been commented on by many observers. The Association of Municipalities of Ontario has been quite vociferous on the issue (AMO, 1989). The Regional Municipality of Halton, in the Greater Toronto Area, "invested 14 years and many millions of dollars to secure approval to develop a new sanitary landfill" (Poland, 1991, p. 96). Under the Waste Management Act

of 1992, Halton will not be able to site its own landfill. The regulatory history in Ontario is summarized by Damman (1991).

9. The Ontario Waste Reduction Advisory Committee (WRAC) was appointed in 1990 as a successor to the Ontario Recycling Action Committee (Ontario RAC) appointed in 1986. WRAC was formed in the midst of the waste management problems of the GTA and in an environment where multi-materials curbside recycling for residential recyclables had been established as a government-private partnership (WRAC, 1992-2, Appendix A; Hoffman, 1986, p. 20). The Committee was disbanded in the early summer of 1993 (Ontario Recycling Update, 1993-2, p. 20).

WRAC was a multi-stakeholder group of twenty members representing manufacturers, retailers, the fast food industry, waste management and recycling industry, environmental groups, secondary materials processors and municipal governments. WRAC had funding for a small permanent staff and office and a budget to retain specialized consulting services. It operated through a series of sub-committees and task groups. Members of sub-committees and task groups were drawn from external agencies with relevant expertise as well as from members of WRAC. The reports and recommendations issued by WRAC represented a consensus of the membership.

10. Broadly based participation of interest groups with a legitimate stake is necessary if any model is to achieve success. The required range of topics for the solid waste problem includes issues of ethics, of equity, of efficiency, of various physical sciences and of matters which transcend the traditional market (externalities). This range is too broad to be left to traditional market processes. There are substantial risks in adopting the multi-stakeholder, consensual approach to decision-making. One or more of the parties could "high-jack" the process; one or more could be left out. Totally irreconcilable differences could result in a consensus not being possible. We will not know until we try.
11. "3Rs" is the short form for the hierarchy of waste management techniques: Reduce at source, Reuse and Recycle. The original hierarchy was "4Rs": Reduce at source, Reuse, Recycle, and Recover (energy) but the Ontario Minister of Environment ruled out incineration as a future waste management technique in Ontario (Ontario Environment, April 11, 1991). The original hierarchy was developed by the US EPA as:

a preferred waste management strategy or set of priority pathways for hazardous waste control that adequately protects the public health and the environment. The priority pathways are equally appropriate for routine (non-hazardous) waste management (US EPA, 1976, p. 35050).

Golueke *et al.* draw a distinction between reduction, reuse, and recycling without indicating a priority. Reuse is exemplified as sand derived from old bottles being used in the production of landscaping sand or fibreglass. Recycling includes direct and indirect recycling. The former sees the salvage process generating basic resources which can return to the raw material stream. Indirect recycling involves the use of processes such as pyrolysis, wet oxidation, rendering and reprocessing before the basic resources return to the raw material input stream (Golueke, 1970, p. 1-7).

12. Recall that WRAC's discussion of "a more sustainable waste management system" primarily focused on the "dry recyclables" components of the waste stream. This focus reflected the importance of working out the relationships among various interest groups. The question of organic waste, while important from landfill capacity and sustainable development perspectives, does not face the same complexity of stakeholder interests. While the "3Rs options" are defined to include composting of organic materials, the dry recyclables continue to be the major focus of such options.
13. Ciriacy-Wantrup traces the origins of interest in the subject to the conservation movement of the late nineteenth century which focused on the need for wilderness preservation (Ciriacy-Wantrup, 1963, p. 5). Canada had a Commission on Conservation in the early part of this century. In 1915 the Commission commented: "Each generation is entitled to the interest on the natural capital, but the principal should be handed on unimpaired" (Keating, 1989, p. 24). In its submission to the "MacDonald Royal Commission," Environment Canada talks of a sustainable development perspective which sees economic activity working in harmony with the environment to produce the quality of life to which most Canadians aspire (Environment Canada, 1984).
14. CCREM was established in 1971 as a successor to the Canadian Council of Resource Ministers which was established in 1964. The aim of CCREM was to provide for intergovernmental co-operation on issues of natural resource development and environmental protection. In 1988, it became the Canadian Council of Ministers of the Environment (CCME). In 1991, the Secretariat of CCME relocated from Ottawa to Winnipeg (Skogstad and Kopas, 1992, p. 48).
15. A few collectors of the memorabilia of packaging and consumerism already consider the used beverage can, along with soft drink and beer bottles, as worthy of preservation. The goals of the collectors include assembling the most brands, rare brands and unique designs. From the point of view of sustainable development and the Stewardship Approach, the main social purpose of conserving the used cans, of course, will be to reclaim the aluminum. As the majority of the reclaimed aluminum will be used to make new beverage cans, the cans will become "durable" as in the empires and dynasties of past years.
16. This discussion will focus largely on conservation and materials policy for non-organic wastes. As explained earlier these dry recyclables are the focus of much debate over the roles and responsibilities of various stakeholders. The reclaimed materials are known as "secondary materials" or "secondary resources."
17. The program, dubbed "Big Bucks" by the company started in 1986. Two of the yield improvements include recovering cartons of single serving pouches previously discarded at the checkweigher only because of a missing pouch; and salvaging undamaged chewy bars previously dumped when the wrapping machine went down. The ideas are so simple and the return so substantial, one must wonder why these steps were not taken prior to 1986. However, this question arises in almost all such examples reported in the literature.
18. The U.S. Office of Technology Assessment found it necessary to point out the obvious. "'Source Separation' is a misnomer. Rather than separation, householders and other generators of waste simply avoid mixing waste prior to collection" (US OTA, 1979, p. 69). It is useful to repeat the reminder.

19. This is the organization set up in 1986 to flow funds from industry to the municipal Blue Box program for curbside recycling in Ontario. For the first five year plan, the organization was known as OMMRI. In 1990, a second plan was undertaken with funding provided by an expanded industry membership. The organization then was called OMMRI: Corporations in Support of Recycling. At this time, the goals of the organization formally expanded beyond support for curbside recycling programs (OMMRI, 1990).
20. When coal burning furnaces were used for heating homes and businesses, separate collection of cinders was arranged. Presumably the impetus for separate collection was fire safety. Cinders could be used as traction grit in the winter and likely as landfill.
21. Discussion of the U.S. situation can be found in Tietenberg (1992), US OTA (1989), and Page (1977). All cite many previous studies. The Canadian taxation situation is discussed in Anderson (1991) and Environment Canada (1992).
22. The softwood lumber trade dispute between Canada and the United States is based on these kinds of considerations. Several provincial forestry levies were increased in an attempt to overcome the perception of subsidy (Anderson, 1991, p. 210). The issue of U.S. timber subsidies is discussed in OTA (1989). In June 1992, *Resource Recycling* magazine reported on an unpublished report prepared for the US EPA on this matter. As of June of 1991, the EPA's consultants estimated that federal subsidies to virgin paper production ranged between \$488 million and \$709 million. These amounts equal between 1.89% and 2.75% of the cost of materials. The subsidy arises through tax benefits, below-cost timber sales, energy subsidies and water subsidies (Powell, 1992, p. 44).
23. Ontario has several levels of municipalities. The reference here is to Regional Municipalities similar to Metro Toronto, Halton, Peel and Durham mentioned above.
24. The distributor is defined to be the "brand-owner" in this model.
25. The Manitoba Soft Drink Association set up MSDRI in 1984 to undertake beverage container recycling in the province through a system of buy-back centres. MSDRI has since signed agreements with the Manitoba Liquor Control Commission to buy-back and recycle non-deposit containers sold by the Commission. A similar deal has been struck with some of the juice beverage and bottled water distributors. MSDRI has recently become a partner with the City of Winnipeg in the operation of multi-material collection depots in the city. MSDRI contributes to the capital and operating cost of the depots. The City tips the collected aluminum and PET beverage containers at MSDRI's processing plant without charge.
26. The GPMC is the national trade association of manufacturers of food and beverage products, household products, health and beauty products and paper products. It has 165 members. The Canadian Soft Drink Association and the Canadian Council of Grocery Distributors are partners in the model (Rowan, 1993, p. 4).
27. In April 1993, the Ontario Minister of Environment and Energy announced new regulations that require about 7000 "major" waste generators in this sector to conduct waste audits, develop waste reduction work plans and carry out source separation and recycling programs for corrugated cardboard, aluminum, glass and steel food containers, fine paper, newsprint, wood, concrete, brick, drywall, steel and certain plastics (Ontario Recycling Update, 1993-2, p. 1).

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