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Analysis of National Solid Waste Recycling Programs and Development of Solid Waste Recycling Cost Functions: A Summary of the Literature

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In response to concerns raised by the federal government, state governments, and the public at large, the philosophy of “reduce, reuse, and recycle" has been implemented to varying degrees and across diverse policies and programs in American communities. Perhaps as a reflection of this diversity, the recycling literature between 1990-95 exhibits the controversy that exists today over choices for collection processes, incentives for participation, materials processing and marketing, financing options, and decision-making mechanisms.

This paper summarizes the 1990-95 recycling literature within the following broad subject categories:

- descriptive data/information on solid waste recycling programs
- community/environmental features related to recycling operations
- materials processing and marketing
- recycling program finances
- decision-making processes

Within these categories, the principal subjects of research, the various research approaches employed, issues and findings, and neglected areas of study are identified and discussed. Citations of some of the prominent contributions in each area are noted. This summary is followed by a detailed listing of articles, organized by primary subject matter and author(s). In addition, we have included 38 supplemental articles outside the 1990-95 time frame. Although these articles are beyond the scope of the task, they are included for their contribution to the solid waste recycling literature.

The literature review is inclusive in that it contains articles from both academic and popular press sources. The latter supports our effort to assist practitioners who are dealing with solid waste recycling issues on a daily basis, while the former provides a comprehensive review for researchers. It should be noted that criteria for identifying the key findings in each article were: (1) suggested in the abstract, if one existed; (2) suggested by the author(s) in the text or conclusion of the articles; or (3) subjectively identified from the emphases the author(s) made in the article. Although much effort went into making this literature review as thorough and comprehensive a summary as possible, the information presented is a reference work that can never be fully complete.

Appendix A includes a list of all journals searched for the literature review and Appendix B is a glossary of terms found in the literature review.

1.0 Descriptive Data/Information on Solid Waste Recycling Programs

The majority of the descriptive research on solid waste recycling programs focuses on existing U.S. and foreign solid waste collection and processing infrastructure. Research methods include specific and comparative case studies using quantitative and qualitative measures of performance of U.S. city and state initiatives as well as programs in Canada, Brazil, Singapore, and other international efforts. Commonly addressed issues include details of the motivation for recycling initiatives; methods of collection and materials collected; materials processing methods and infrastructure; and waste reduction, recycling, landfilling, and/or incineration measures.

Key findings for domestic operations include:

(1) mobile drop-off systems may prove to be an effective alternative to less cost-effective or impractical implementation of curbside collection (Watson 1991);

(2) the collection infrastructure for paper goods has expanded faster than processing capability with a corresponding effect on market prices (Ducey 1991);

(3) the debate over "bin versus bag" methods of curbside collection is best resolved by local decision makers choosing the method that best suits their needs (Polk 1994);

(4) large U.S. cities have tried to improve recycling collection despite minimal net benefits and have reduced their costs while increasing diversion rates (White 1991);

(5) state initiatives have contributed to increased recycling rates, expanded curbside collection, source reduction, and improved markets for recycled materials (Hursch 1993; Sudol 1991); and

(6) crisis-driven recycling activity (e.g., local responses to unfunded mandates, landfill shortfalls, etc.) in some states has created a situation of need for comprehensive recycling programs but few financial resources (Watson 1991).

From international research, it appears that:

(1) fundamental obstacles to solid waste management in some Third World countries include too much service (e.g., unneeded daily collection), local government corruption, lack of program coordination, inconsistent cash flow, and a failure to recognize local opportunities (e.g., recyclables markets) (Ward 1995);

(2) economic incentives in themselves have functioned to encourage recycling (Watson 1990);

(3) municipal solid waste (MSW) reuse and recycling in some Third World countries operate through a disorganized, informal sector that should be supported and empowered to enhance MSW management (Iqbal and Mansoor 1993); and

(4) regional culture is an important influence on acceptance of recycling initiatives (Wells 1991).

Especially with regard to major Canadian cities, there is an emphasis on source reduction to get the most material recovery/waste diversion for the lowest cost, while phasing in comprehensive recycling programs to meet waste reduction goals (Apotheker 1992).

The research describing features of various program types generally employs specific and comparative case studies of plastic bag collection systems (Polk 1994; Wagner 1991), barriers to recycling programs (White 1991), WasteCap programs (Hess and Bishop 1995), MSW reduction strategies (Gillis 1992; Pleuddemann 1994), volume-based approaches (Cuthbert 1994; Skumatz 1990), and the German Green Dot program (Rousso 1994). Research in this subcategory exhibits qualitative discussions of program details, costs/benefits, and incentives/disincentives to program implementation and/or participation. However, a 10-year quantitative case study of Seattle's program estimates the contribution of volume-based garbage rates to successful recycling/waste reduction programs (Skumatz 1990).

Significant findings concerning program types include:

(1) volume-based rate systems can contribute to recycling/waste reduction success without legal requirements that mandate citizen recycling (Miranda 1993; Miranda *et al*. 1994; Skumatz 1990);

(2) recycling program approaches vary among cities depending on presence/absence of the constraints of unionized labor, large bureaucracies, cultural diversity, socio-economic status diversity, and legal, political, financial, and organizational barriers (White 1991);

(3) many communities opt for the cost-saving benefits of plastic bag collection systems (limited up-front costs, use of existing collection infrastructure/equipment, reduced marketing/advertising costs) despite disadvantages of disproportionate costs to low-income residents, costly content processing, and poor aftermarkets (Polk 1994);

(4) key state and local MSW strategies include financial disincentives to waste disposal, consumer education, product restrictions/bans, and product standards (Hursch 1993; Pleuddemann 1994; Sudol 1991); and

(5) the European Community's packaging materials recycling strategy will require attention to technical standards, local interpretation, and restrictions on competition before standardized approaches can be developed (*The Economist* 1995).

Two quantitative case studies present findings on the program effects of including various materials in the recycling effort. An assessment of Oregon's beverage container deposit system finds that legal mandates, comprehensive recovery systems, technological advancements in material sorting, and maximized public program access contribute to program success and add to the feasibility of mixed plastics recycling (Powell 1995). A review of EPA reports and local/state data concerning organic waste recycling suggests that including organic material in recycling programs benefits

communities seeking lower landfill costs and larger stocks of salable compost (Gillis 1992).

2.0 Community/Environmental Features Related to Recycling Operations

The principal focus of research in this category concerns incentive structures and their record of performance. Within this research area, articles tend to focus on one of three general issue areas:

(1) the relative impacts of various hypothesized internal and external incentives to recycling (Allen *et al*. 1993; Dinan 1992; Miranda *et al*. 1994);

(2) the relative influence of unit-pricing incentives on recycling participation (Cuthbert 1994; Miranda *et al*. 1994); and

(3) the influence of specific incentives other than unit-pricing approaches (Hong *et al*. 1993; Vining and Ebreo 1990; Ward 1995).

Methods include specific qualitative case studies, survey analysis, census analysis, marginal cost pricing studies, controlled experiments, and nonscientific experiments with analyses ranging from qualitative argument and development of theoretical frameworks to cross-tabular analysis and various regression analysis techniques for hypothesis testing.

Studies seeking an understanding of many hypothesized incentives focus on such issues as:

(1) the relative influence of monitoring (e.g., mandatory comprehensive reporting systems) versus convenience (e.g., curbside charges or flexible systems of retail charges) (Menell 1990);

(2) effects on household welfare gains attributable to unit pricing (Jenkins 1991);

(3) the relative impact of commitment and incentive-based efforts to promote recycling (Wang and Katzev 1990);

(4) factors contributing to societal costs of waste disposal and economic incentives to change consumption patterns (Dinan 1992; Menell 1990);

(5) the influence of mandatory versus voluntary programs and fee versus no-fee programs (Fenton and Hanley 1995; Judge and Becker 1993); and

(6) factors influencing household recycling incentives (Dinan 1992; Hong *et al*. 1993; Miranda *et al*. 1994).

Results from this area of research find that:

(1) household recycling varies as a function of convenience and demographic characteristics. Consideration only of costs/benefits of recycling ignores social importance (e.g., altruistic incentives) which also influences participation (Judge and Becker 1993). In another study, however, individual education level and the time a recycling program has been in effect were found to significantly influence household choice to recycle, while penalties, convenience, and types of materials recycled were insignificant influences on choice (Duggal *et al*. 1991);

(2) group commitment (e.g., a group pledge to participate in the recycling effort) without added incentives is a more significant influence on recycling behavior than individual commitment (e.g., an individually pledged commitment) without incentives (Wang and Katzev 1990; Katzev and Pardini 1987);

(3) options for household waste reduction incentives include household charges, combined disposal tax/reuse subsidies, and recycling credit systems (Dinan 1992; Dobbs 1991);

(4) in Ward's framework, voluntary-fee recycling programs approximate performance of mandatory programs (Ward 1995); and

(5) curbside charges and/or retail charges are strong incentives for source reduction, material separation, and purchase of reusable/recyclable materials (Menell 1990).

Research on unit pricing addresses such issues as advantages/disadvantages (e.g., advantage of overcoming public concerns for convenience versus such disadvantages as low levels of public funding for waste management) of the usefulness of hybrid rate options (Skumatz 1993); effects on diversion, landfilling, and source reduction (Cuthbert 1994; Miranda 1993; Miranda *et al*. 1994); comparison with set-fee systems (Harder and Knox 1993); effects on fund collection, recycling, and waste reduction (Moriarty 1994; Morris and Holthausen 1994); comparison with weight-based programs (Skumatz *et al*. 1994); and influence on residential waste production (Glenn and Byrd 1990; Stone and Hansen 1991).

Information gained from this research includes:

(1) various tests confirm previous findings that unit-pricing programs increase recycling behavior, but there are contradictory findings as to the effect on source reduction (Hong *et al*. 1993; Hornik *et al*. 1995; Miranda 1993; Repetto *et al*. 1992);

(2) program effects (waste reduction/increased recycling) are dependent on both community and program features, but generally, high prices tend to modify waste behavior (Hong *et al*. 1993; Jenkins 1991);

(3) hybrid rate options may benefit communities resistant to unit pricing due to concerns for convenience, implementation costs, or revenue recovery (Skumatz 1993);

(4) unit pricing contributes to less landfilling tonnage, but there is no significant difference in source reduction between high-fee and low-fee communities (Miranda 1993); and

(5) weight-based rates may provide a greater incentive for source reduction than unit pricing programs (Skumatz *et al*. 1994).

A great deal of research focuses on a wide variety of incentives issues including the effects of beverage container deposit laws (BCDL's), "polluter pays" laws, coupon incentives, curbside recycling, and incentives for multi-family property residents. In this regard,

(1) programs with both BCDL's and curbside recycling have higher costs. BCDL's do not contribute to higher waste diversion in communities with existing recycling programs (Alter 1993);

(2) coupon incentives positively influence recycling behavior, and coupon value is directly related to increased recycling frequency (Allen *et al*. 1993);

(3) maintaining recycling behavior and encouraging other conservation activities may be more effective than forcing initial compliance (Vining and Ebreo 1992);

(4) the strongest influences on multi-family unit recycling rates are management interest in recycling, convenience to residents, socio-economic factors, and resident organization (Yuhas and Hyde 1991); and

(5) as revealed by Germany's Green Dot program, "polluter pays" policies to shift economic costs from the public sector to private waste generators are a viable policy alternative (Rousso and Shah 1994).

Considerable study has focused on the issue of who recycles and why. This research seeks to address:

(1) the difference between recyclers and non-recyclers (Hornik *et al*. 1995; Lansana 1993; Oskamp *et al*. 1991; Vining and Ebreo 1990);

(2) the extent to which recycling is altruistic behavior (DeYoung 1990; Hopper and Nielsen 1991);

(3) factors contributing to household recycling rates (Matsuto and Ham 1990; Oskamp *et al*. 1991; Saltzman *et al*. 1993);

(4) the influence of social context on recycling behavior (Derksen and Gartrell 1993);

(5) the effects of income on recycling behavior (Saltzman *et al.* 1993);

(6) effects of demographic (e.g., age, education, income, race, etc.), attitudinal (e.g., pro- versus anti-recycling attitudes), and behavioral (e.g., external influences on behavior

such as convenience, direct or indirect costs, etc.) factors on recycling participation (Hornik *et al*. 1995; Oskamp *et al*. 1991);

(7) influence of recycling education on participation (DeYoung 1990);

(8) the influence of lifestyle on household waste/recycling generation (Matsuto and Ham 1990); and

(9) the effect of income and owner occupancy on curbside participation (Sudol and Zach 1991).

With one exception key findings in this broad area of research suggest the importance of internal facilitators (e.g., demographic characteristics, attitudes, social norms) as incentives to recycle. These include:

(1) internal facilitators (e.g., education, pro-recycling attitudes) are the strongest predictors of recycling behavior, with external incentives (e.g., economic or punitive) being the next best predictors (Hornik *et al*. 1995);

(2) recycling behavior is consistent with altruistic behavior, influenced by social and personal norms and an awareness of consequences (Hopper and Nielsen 1991). In another study, however, demographic (e.g., age, education, income, race, etc.), attitudinal (e.g., pro- versus anti-recycling sentiments), and behavioral (e.g., influences such as convenience, direct or indirect costs, etc.) did not predict curbside participation, while simple conservation knowledge did. This study also finds that demographic variables (especially income) reflect different impacts on recycling levels, depending on the material in question (Duggal *et al*. 1991; Reschovsky and Stone 1994; Saltzman *et al.* 1993);

(3) recycling behavior is consistent with altruistic behavior, influenced by social and personal norms and an awareness of consequences (Hopper and Nielsen 1991);

(4) variation in participation rates across communities is due mainly to differences in demographic characteristics (e.g., age, education, race) (Lansana 1993);

(5) recycling education programs that promote pro-recycling attitudes should focus on how to recycle and non-monetary incentives (DeYoung 1990); and

(6) there is a positive relationship between income and owner occupancy indicators and curbside recycling participation.

One study, however, suggests that the strongest predictor of recycling behavior is easy and convenient access (i.e., the opportunity costs associated with access). Social context (in this study, presented as broad, societal support or lack of support for recycling) has a strong effect but is insufficient in itself to produce desired behavior. Individual environmental concern enhances recycling participation but does not overcome the barrier of lack of access (Derksen and Gartrell 1993).

Generally, the work to date highlights the debate over the influence of internal (e.g., altruism, education, attitude) and external (e.g., economic or punitive) incentives to recycle (Sudol and Zach 1991).

3.0 Materials Processing and Marketing

The principal focus of research in this subject area concerns trends, instability, and predictability of material prices. In addition to broad assessments of recycling markets in general, researchers also address key issues concerning old newspaper (ONP) and recycled plastics markets. With few exceptions, analyses employ aggregate market data to describe or interpret materials price/market questions that assess the influence of advance disposal fees on recyclable markets; cooperative marketing of recyclables; public attitudes and recyclable markets; disposal costs and product prices; macroeconomic effects and market stability; recyclables recovery and market prices; marketable permit systems and ONP demand; improved technology, regional demand, and export markets and ONP supply/demand; economic and political forces and the plastics recycling market.

The findings in this research show that:

(1) advance disposal fees (e.g., predetermined fees included in retail price of items) stimulate demand for recovered materials by showing consumers that some products have higher environmental costs than others (Martin 1994);

(2) the potential of cooperative marketing is largely untapped and the influence of private sector and local government competition is as yet unknown (Kohrell and Olsen 1991);

(3) expanding recycled goods markets will require improving the image of recycled goods among consumers and industry and initiating cost incentives to promote recycled goods purchases over virgin materials products (Kashmanian *et al*. 1990);

(4) the uncontrolled market forces of supply and demand, world events, and macroeconomic effects can influence recyclable material values (Misner 1991);

(5) changes in industry use of recovered materials and a healthy economy contribute to higher demand for recycled materials (Sutherland *et al*. 1995);

(6) marketable permit systems for ONP contribute to increased demand for ONP (Dinan 1992); and

(7) despite an overwhelming demand market, the plastics recycling market must still overcome the obstacles of public misperceptions of plastic materials (e.g., that plastics are not recyclable or that recycled plastic items are in some way inferior to “new” plastic products), processing problems, and material bulk that increases transportation costs (Powell 1990).

Studies addressing the legal mechanisms used to promote improved materials processing and/or marketing use both qualitative and quantitative case study

assessments of cooperative marketing arrangements between U.S. communities, recycling organizations in the United States and Canada, and the impacts of zoning ordinances, recycled content laws, and packaging take-back programs. The contributions found in this work are:

(1) there has been continued growth in membership and budgets of recycling organizations, and the top policy priority continues to be market development (Apotheker 1992, 1993);

(2) cooperative marketing programs have been established in both rural and urban environments with no predictable size/population relationship (Johnson and Kohrell 1992);

(3) German packaging waste take-back ordinances have improved the demand side of the recycled product market, are a less expensive option than landfilling or incineration, and have contributed to source reduction/recycling (Burt 1994); and

(4) recycled content laws are relatively inexpensive to implement, have experienced high company compliance, and may contribute to improved markets for post-consumer materials (Aunan and Martin 1994).

Other research in this subject category includes assessments of options to improve end-use markets and increase waste diversion, costs and benefits of waste management strategies, and state approaches to overcoming barriers to recycling program implementation, participation, and marketing. Findings consist of:

(1) MSW strategies using both composting and recycling reduce landfilling and save energy, with combined strategies producing the greatest net benefits (Powers 1995);

(2) taxes on virgin materials, minimum content standards, material specific-use requirements, “take-back” programs, and creation of a national secondary materials trust fund are options that may improve end-use markets and increase waste diversion (Grogan 1993); and

(3) public and legislative interest, private incentives, and governmental initiative and funding can overcome barriers to recycling and market development (Powell 1990).

4.0 Recycling Program Finances

A fundamental concern in this subject category has been the factors affecting perceived financial feasibility of recycling programs. The research reveals a continuing controversy over the relative costs/benefits of recycling versus other waste management strategies and includes a variety of qualitative and sophisticated quantitative approaches. Key results cover:

(1) in some circumstances, disposal costs may generally exceed recycling costs (Bogert and Morris 1993);

(2) recycling initiatives have been pushed past economically efficient levels due to landfill siting problems, misperceptions of environmental impacts of landfills, overestimates of recycling benefits, and underestimates of recycling costs (Wiseman 1992);

(3) savings in transportation costs (e.g., reduced loads due to diversion of recyclables) alone may economically justify recycling programs (Highfill *et al*. 1994);

(4) there is a continuing need for research to identify and communicate the true social costs of various waste management scenarios, and to rectify problems where a lack of cost data and analysis exist (Wiseman 1991);

(5) desirability of incineration and the optimal size of energy recovery facilities depend on costs of the available options and waste stream characteristics. Under most conditions, allocating resources to incineration reduces incentives to recycle (Keeler and Renkow 1994);

(6) recycling may be no more than a short-run solution. Final-goods producers are effectively subsidized by voluntary recycling efforts, and their accumulation intensity (i.e., high output growth) rises to a point that offsets unit savings of primary/virgin materials (Mainwaring 1995; Nestor 1991). Implication is that long-term concerns for environmental sustainability must first contend with high-consumption, high-output market demands; and

(7) because waste disposal costs tend to increase as landfills are filled, it may be optimal to postpone waste reduction programs until landfills are partially full (Ready and Ready 1995).

Research addressing methods for determining/evaluating program costs covers such questions as optimal selection and scheduling to minimize total present value costs, the most efficient incentive systems, correct fee calculation, socially optimal levels of recycling, equitable distribution of plastic collection costs, and problems posed by recycling program data. Findings include:

(1) economic and optimization theory can benefit recycling program design efforts (Lund 1990);

(2) a system of Pigouvian taxes and government mandated refunds may be a more efficient alternative to existing volume-based fees and lump sum taxes (Atri and Schellenberg 1995);

(3) measurable/workable collection fee structures require accurate measurement of household garbage generation to provide a fair return at minimal public cost (Johnson and Carlson 1991);

(4) recycling is both economically and environmentally justified as an approach to balance resource and waste stocks (Huhtala 1994);

(5) available technology and current market prices can keep costs of plastic collection consistent with other materials (Perkins 1991); and

(6) recycling program data generally lack standardized measures, and consistent, standard, and meaningful terminology (deKadt 1992).

Other issues addressed by research in this subject area include the relative cost-effectiveness of curbside recycling versus landfilling, recycling industry contributions to employment and capital demands/technical assistance needs, impacts of financing methods on recycling program success, and the effect of Pigouvian tax/price solutions on litter and waste management.

Available studies indicate that:

(1) curbside recycling may be marginally cost-effective under favorable conditions. Low landfill disposal costs limit the impact of avoided costs (Deyle and Schade 1991);

(2) the potential for recycling-industry employment should encourage state efforts to provide capital access, technical assistance, and a stable regulatory environment (Fox 1991);

(3) pay-per-bag systems are the best method to divert waste from landfills without imposing tax burdens on citizens; flat fee systems lack recycling incentives (Moriarty 1994); and

(4) from the assumptions that high user charges encourage illegal dumping/burning and low user charges encourage higher consumption, findings suggest that refunds or user subsidies (in lieu of user charges for trash collection/disposal) may be used to balance these negative behaviors and enhance proper waste disposal practices (Dobbs 1991; Fullerton and Kinnaman 1995).

5.0 Decision-Making Processes

The principal focus of research in this subject area is with the process, change, and evolution of program design. Research questions address such issues as what variables influence municipal choices to adopt curbside recycling; the influence of citizen background characteristics and attitudes on preferred policy options; determinants of recycling program success; approaches to understanding recycling behavior; the value of long-term planning and financing; the influence of politics on MSW management decision making; alternatives to adversarial relations between government and business; and municipal responses to public, political, and state pressures to recycle.

Key findings in this subject area include:

(1) the need to recycle (e.g., public demand, landfill shortages, legal mandates), intergovernmental influence, and economic factors are significantly related to municipal decisions to recycle (West 1992);

(2) citizen environmental attitude indicators are significantly associated with recycling preferences, and should be considered by program planners to devise options that will improve participation (Bacot *et al*. 1993);

(3) recycling program success is more dependent on the policies chosen, how they are selected, and how they are implemented rather than on local community characteristics (Folz and Hazlett 1991);

(4) democratizing program planning and design and mandatory participation significantly influence citizen participation (Folz 1991);

(5) it may be efficient to implement options more expensive than landfills (e.g., composting, recycling, incineration) to defer the higher costs of future, more expensive landfills (Everett and Modak 1993);

(6) developing integrated solid waste management plans and adequate information, expanding recycling/education efforts, and developing flexible financing plans can help program planners respond to changing program needs (Folz 1991);

(7) despite lower costs than other waste management alternatives, landfill siting and capacity issues present political difficulties that encourage costly recycling efforts. Policies should be established to maintain landfill standards, impose unit pricing to place cost/benefit assessment on households, and reduce local power to grant or deny landfill permits (Wiseman 1992); and

(8) the growth in curbside programs confirms the political necessity of recycling, but rapid growth can contribute to program chaos (Watson 1990).

The bulk of the remaining literature addressing this subject category focuses primarily on intergovernmental influences on decision making and operational problems and challenges in the decision-making process. Research questions address the nature of current and future state solid waste management initiatives; the influence of voluntary or mandatory minimum content legislation; the problems and challenges of recycling (e.g., participation, development of recyclable markets); influences on state inclination to recycle; the effects of economics and federal, state, and local policy responses on wastepaper recovery, markets, production, and utilization; effects of federal subsidies on virgin material use; effectiveness of mandatory participation in business/institution recycling programs; recycling strategies to overcome implementation/economic barriers; and the effects of regional economics on recycling.

Some conclusions from this research reveal:

(1) voluntary or mandatory minimum content legislation can close the recycling loop in ONP markets (Beck and Grogan 1991);

(2) recycling policy initiatives have overlooked the industrial changes needed to shift to recycling and may undermine financing for domestic recycling while subsidizing foreign markets with inexpensive raw materials (Relis 1992);

(3) the influence of population density, region, and environmental bureaucratic strength, innovativeness, and commitment are significant predictors of a state's recycling effort (Khator 1993);

(4) ONP recovery/recycling policies have been implemented with no regard for economic and social costs of various alternatives (Wiseman 1990);

(5) while federal energy subsidies may be an economic barrier to recycling, several federal policies benefiting virgin resource industries do not act as significant barriers (Powell 1992);

(6) the strongest impetus for local recycling programs is pressure from state government (Khator and Huffman 1993); and

(7) the most important factor in improving program performance is to find markets for recyclables in one's own state (Khator and Huffman 1993).

Conclusion

This literature review covered 173 recycling-related citations for the period 1990-95.[1] As might be expected, the majority of this research concentrated on subject areas that are still open to debate. This is likely the best explanation for the focus on the nature and performance of incentive structures, local government practices and involvement in material processing and marketing, factors affecting perceived financial feasibility of recycling programs, and decision-making processes in program design.

The overwhelming preference across this body of research has been for both qualitative and quantitative case study, either of a specific case or comparison across cases. Generally the quantitative work consists of single or bivariate analysis of aggregate data, but there is evidence of a trend to use more sophisticated methods to test hypotheses concerning recycling incentives, recyclable markets, and the costs/benefits of recycling versus other MSW options.

In addition to a general lack of sophisticated, generalizable research, there are significant gaps in research of certain subjects including description of equipment configurations, composting operations, and generators (individuals and/or industrial), and management/administration decision-making processes. Again, a lack of controversy may be the best explanation for the disinclination of researchers to broach these subjects.

[1]In addition, we have included 38 supplemental articles outside the 1990-95 time frame. Although these articles are beyond the scope of the task, they are included for their contribution to the solid waste recycling literature.

Generally the findings reflect the diversity in program choice, incentives employed, markets exploited, financing methods, and decision making that is to be expected given the degree of discretion available to state and local governments and populations. Given that, a few findings stand out:

(1) state initiatives have contributed to increased recycling rates, expanded curbside collection, source reduction, and improved markets for recyclable materials;

(2) curbside and/or retail charges are strong incentives for source reduction, material separation, and purchase of reusable/recyclable materials;

(3) pay-per-bag systems serve to divert waste from landfills without imposing tax burdens on citizens, while flat fee systems lack recycling incentives; and

(4) democratizing program planning and design, and mandatory participation significantly influence citizen participation.

The following section contains summaries of each publication included in this literature review, organized by primary subject code in alphabetical order by author(s). The coding scheme is:

1.00 Descriptive data/information on SW recycling programs
- 1.01 program types
- 1.02 materials recycled
- 1.03 participation trends, recycling/recovery rates
- 1.04 existing SW collection/processing infrastructure

2.0 Community and environmental features related to recycling operations
- 2.01 who recycles and why
- 2.02 incentive structures . . . record of performance
- 2.03 public participation in program design/operation

3.0 Materials processing and marketing
- 3.01 problems, challenges
- 3.02 local government practices . . . technical aspects
- 3.03 legal vehicles . . . in-house, contracts, cooperative agreements, regional associations
- 3.04 material prices, trends, instability, and predictability

4.0 Recycling program finances
- 4.01 problems, challenges
- 4.02 local government practices
- 4.03 cost elements of curbside, drop-off, and buy-back operations
- 4.04 methodologies for determining/evaluating program costs
- 4.05 public versus private sector risk assumption
- 4.06 factors that affect the perceived financial feasibility
- 4.07 recyclables trading/futures markets

5.0 Decision-making processes
- 5.01 program design process/changes/evolution
- 5.02 management/administration mechanisms
- 5.03 intergovernmental dimension . . . state/national policies and/or standards
- 5.04 operational problems, challenges
- 5.05 online data bases/information sources/software to help recycling program design/decision makers

Use coding
- 1 academic orientation
- 2 practitioner orientation
- 3 applicable as both academic/practitioner reference

1.0 DESCRIPTIVE DATA/INFORMATION ON SW RECYCLING PROGRAMS

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
1.01 Program Types					
Hess, Emily and Tim Bishopbric	1995	"WasteCap: A Business-to-Business Recycling and Waste Reduction Program" *Resource Recycling*	(Nov.) 39-42	Q: What factors contribute to the success of WasteCap programs? Discusses the nonregulatory, nongovernmental approach to waste reduction and recycling adopted by five states. Findings: Success depends on program commitment by state government and the business community; its function to link business people who can share solutions; confidentiality for service users; access for all businesses; no service or membership fees. Business communities' control is a key element - success or failure reflects directly on business commitment.	2
Pleuddemann, David W.	1994	"Creating Incentives for Waste Reduction: State and Local Perspective" *Journal of Environmental Health*	57 23-26	General list/discussion of "reduce, reuse, recycle" waste management strategies used at state and local levels. Identifies financial disincentives, consumer education, product restrictions/bans, and product standards as key MSW reduction strategies. Also includes discussion of procurement policies, tax incentives, fees, source separation, deposit programs, disposal restrictions, labeling requirements, education, and grants and loans as key elements of recycling strategies.	3
Polk, Tom	1994	"Plastic Bags for Recycling Collection: A Mixed Bag of Results" *Resource Recycling*	(Feb.) 45-48	Q: What are the advantages, disadvantages of plastic bag collection systems? Case study comparison of several community systems. Details collection options, bag processing, and marketing. Suggests that advantages include limited up-front costs for municipalities, savings from use of existing collection trucks/ease of implementation, and reduced marketing/advertising costs since manufacturers will usually provide educational/promotional materials. Suggests disadvantages include disproportionate costs to low-income residents, time-consuming/expensive content processing, bag contamination that limits recyclability, and poor aftermarkets due to use of inconsistent bag types by residents. Suggests that many communities continue to opt for the cost benefits despite disadvantages.	3
Skumatz, Lisa	1990	"The Buck is Mightier than the Can" *Biocycle*	(Jan.) 40-42	Q: Do volume-based garbage rates contribute to successful recycling/waste reduction programs? Case study of Seattle program. Reviews 10-year aggregate results of Seattle program. Findings suggest that volume-based rates have led to successful recycling and waste reduction goals without mandatory features.	3
The Economist	1995	" European Rubbish: Tied up in Knots" *The Economist*	335 62	Q: What are the anticipated effects of new European directives to recycle packaging materials? Presents details of the new directive, suggests questions that will remain unanswered until future laws regarding technical standards, local interpretation, and restrictions on competition are developed. Suggests need for the European Commission to take the initiative in standardizing approaches to implement the directive and draw up new packaging legislation.	2
White, Michele Marie	1991	"Big Cities Recycle" *Resource Recycling*	(Dec.) 38-42	Q: How have large cities overcome barriers to recycling? Describes constraints facing four US cities intent on meeting state-mandated recycling and waste reduction goals: unionized labor; large bureaucracies; diverse culture, language, class; legal constraints; political constraints; financial constraints; organizational constraints. Presents case studies based on interviews with recycling managers in New York, Philadelphia, Los Angeles, and Chicago. Findings: Approaches to implementing recycling programs vary depending on the constraints. Suggests that "continued activism" and financial constraints may lead to more innovations in big city programs.	3
1.02 Materials Recycled					
Gillis, Anna Maria	1992	"Shrinking the Trash Heap" *BioScience*	42 90-93	Q: Can an emphasis on organic solid waste improve the solid waste recovery effort? Review of EPA reports and local/state level data regarding organic waste recycling. Findings suggest that added emphasis	3

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				on recycling of organic materials will benefit communities seeking lower landfilling costs and contribute to added stocks of saleable compost usable in agriculture, horticulture, silviculture, and land reclamation.	
1.02 Materials Recycled (Cont.)					
Powell, Jerry	1995	"Is Mixed Plastic Bottle Recycling Working?" *Resource Recycling*	(Sept.) 17-20	Q: What factors contribute to successful all-bottle plastic recycling? Presents quantitative results of Oregon's beverage container deposit system. Findings: Legal mandates, comprehensive recovery systems, technological advances in material sorting, and maximized public access to the program all contribute to the program's success. Suggests for most curbside programs that mixed plastics collection is not too challenging. Instead recycling programs need to allow some time for program users to add new materials. Also concludes that all-bottle plastics collection is not excessively time-consuming, guaranteed floor prices are a key incentive for suppliers of loose bottles, and healthy market prices have been key to program success. Market unrest and supply issues mean all-bottle recycling is not easy or attractive to all program participants.	3
1.03 Participation Trends, Recycling/Recovery Rates					
BioCycle	1992	"What's New in the Waste Stream" *BioCycle*	(Oct.) 40-41	Q: How has recycling impacted the solid waste stream? Presents aggregate data from various sources. Findings: Recycling has been growing at a rapid pace. Percentages of MSW being recycled continue to increase while landfilling has continued at a slow decline. Glass, metal, and paper recycling has increased. The number of curbside and composting programs have increased. Suggests continued growth in recycling and waste stream diversion, reduced landfilling.	3
Environmental Protection Agency	1995	"Characterization of Municipal Solid Waste in the United States; 1995 Update" *Environmental Protection Agency Report, Washington, DC*	134 pp.	Q: How much MSW is being generated, recovered, discarded in the U.S.; what are trends in MSW management; what are the projections for MSW generation through 2010? Describes national waste stream based on data from 1960-94. Findings: Rate of growth in MSW generation is slowing, per capita MSW generation is expected to remain constant; recycling/composting recovered 24% of MSW in 1994, an estimated 49 million tons; landfills managed 61% of MSW generated, incinerators, 15%. Projected MSW generation is expected to be 223 million tons by 2000, 262 million tons by 2010. Per capita generation rates are projected to remain constant at 4.4 pounds/person/day. Early research suggests source reduction/recycling have potential to reduce greenhouse gas emissions.	3
Felton, K. Mary	1995	"A Snapshot of Waste Generation and Recovery" *Resource Recycling*	(Jan.) 50-53	Q: How much waste is being generated, discarded, and recycled in the US, and what are the projected amounts of waste to be managed in the future? Summary of 1994 EPA Characterization of Municipal Solid Waste in the United States. Findings: MSW generation continued to increase at a slower pace, while per capita generation showed no growth between 1990 and 1993, with projections to decline by 2000. Material recovery increased from 17% in 1990 to 22% in 1993 and is projected to increase to 30% by 2000. Landfilling will continue to be the most common method of waste management.	3
1.04 Existing SW Collection/Processing Infrastructure					
Apotheker, Steve	1993	"Curbside Recycling Collection Trends in the 40 Largest U.S. Cities" *Resource Recycling*	(Dec.) 27-33	Q: What is the status of curbside recycling in the 40 largest U.S. cities? Presents program information collected by interview. Tables present aggregate data regarding recovery/cost levels, program characteristics. Of the interviewed communities, 40% of residents had access to curbside recycling; community motivation stems from high disposal fees, aggressive state mandates, strong markets, and active advocacy groups. Article also suggests that despite marginal net benefits, cities are trying to improve their recycling collection programs and that costs are being reduced, diversion rates are increasing.	3
Apotheker, Steve	1992	"Recycling in Canada's Big Cities" *Resource Recycling*	(Dec.) 37-42		3

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
				Q: How have Canada's major cities confronted the MSW crisis in the face of trying economic times? Profiles different approaches used by Canada's largest cities to develop waste reduction programs. Tables present data regarding recycling collection programs. Findings: Most major cities rely on source reduction efforts to get the most material recovery/waste diversion for the lowest cost. Common use of beverage container deposit systems removes amber glass from the waste stream, frees collection vehicles for other materials. Drop-off recycling sites have been effective opportunities for multi-family dwelling residents to participate. Most large cities are phasing in comprehensive, city-wide recycling collection programs to meet waste reduction goals.	
1.04 Existing SW Collection/Processing Infrastructure (Cont.)					
Ducey, Michael J.	1991	"Market vs. Infrastructure for Waste Paper" *BioCycle*	(May) 36-37	Q. Can national goals of paper recovery for recycling be achieved by 1995? Presents background of market and policy activity, and details the specific elements of the MSW paper product market. Findings suggest that collection infrastructure is expanding faster than processing capability; domestic market prices remain low, while the export market is unstable. Also concludes that recycled paper product markets will grow through the 1990s and recycled wastepaper use in paper production will offer future opportunities to community-based programs.	2
Hursh, Carl	1993	"The Largest State Recycling Program: A Progress Report" *Resource Recycling*	(Jan.) 57-60	Q: How has Pennsylvania overcome barriers to recycling? Discussion plus aggregate data regarding state's implementation of the 1988 Municipal Waste Planning and Waste Reduction Act. Findings: Recycling rates have increased from 2% to 10%, with 18 communities meeting/exceeding the 25% goal. All communities with populations over 5,000 have implemented curbside recycling collection. Total waste production declined from 9.2 million tons in 1988 to 9 million tons in 1991. Data reveal increased buying/use of recycled products, increased recycling education, increased composting.	3
Iqbal, Ali and Syed Mansoor Ali	1993	"Solid Waste Recycling Through Informal Sector in Developing Countries" *Journal of Resource Management and Technology*	21 82-86	Q: What MSW management approaches hold the most promise in developing countries? Employs field interviews and tests of waste materials from the source to disposal to assess recycling and reuse practices in Karachi, Pakistan, and to estimate the separated volumes of recyclable items. Findings suggest that MSW reuse and recycling in Karachi operate "mostly through disorganized and unknown informal sector." Suggests need to recognize, support, and empower this sector to abet MSW management in developing countries.	3
National Renewable Energy Laboratory	1995	"Integrated Solid Waste Management of Seattle, Washington" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Q: How has Seattle, Washington implemented its solid waste program? How much and what types of solid waste were collected during 1992? What were the MSW cost factors in Seattle, the energy consumed to run the program, and the total annual costs to run the program? Detailed description of Seattle's solid waste management program, the costs factors associated with that program, and the tonnage/costs associated with their MSW collection during 1992. Findings: Total FY 1992 costs (collection, transfer, hauling, processing, composting, disposal and marketing of recovered materials) was about $30.2 million, or an estimated $130/ton. Collection and processing accounted for more than half of the total program cost of the program, and transfer, hauling, and disposal accounted for more than 30% of total costs. Curbside collection of 48,200 tons contributed to an incremental savings of $17,200 during 1992, while collection of 45,500 tons of yard waste incurred an incremental cost of $568,000 (or $13/ton).	3
National Renewable Energy Laboratory	1995	"Integrated Solid Waste Management of Scottsdale, Arizona" Report Prepared for the U.S. Department of Energy.		Q: How has Scottsdale, Arizona implemented its solid waste program? How much and what types of solid waste were collected during 1992? What were the MSW cost factors in Scottsdale, the energy consumed to run the program, and the total annual costs to run the program? Detailed description of Scottsdale's solid waste management program, the cost factors associated with that program, and the tonnage/costs associated with their MSW collection during 1992. Findings: Total FY 1992 costs (collection, transfer, hauling, processing, composting, disposal and marketing of recovered materials) was about $6.6 million, or an estimated $59/ton. Collection costs accounted for 62% of total costs; general and administrative expense	3

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		Springfield, VA: National Technical Information Service		was 25% of the total; and landfilling accounted for 14% of total costs. Energy consumed to manage garbage, brush and recyclable was equivalent to a total of 14.2 gallons/ton.	
1.04 Existing SW Collection/Processing Infrastructure (Cont.)					
National Renewable Energy Laboratory	1995	"Integrated Solid Waste Management of Minneapolis, Minnesota" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Q: How has Minneapolis, Minnesota implemented its solid waste program? How much and what types of solid waste were collected during 1992? What were the MSW cost factors in Minneapolis, the energy consumed to run the program, and the total annual costs to run the program? Detailed description of Minneapolis' solid waste management program, the cost factors associated with that program, and the tonnage/costs associated with their MSW collection during 1992. Findings: Total FY 1992 cost (collection, transfer, hauling, processing, composting, disposal and marketing of recovered materials) was about $23.8 million, or an estimated $167/ton. Collection costs accounted for 49% of total costs; general and administrative expense was 19% of the total; and landfilling accounted for 6% of total costs. Energy consumed to manage garbage, yard waste, bulky waste and recyclables was equivalent to a total of 9.7 gallons/ton.	3
National Renewable Energy Laboratory	1995	"Integrated Solid Waste Management of Springfield, Massachusetts" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Q: How has Springfield, Massachusetts implemented its solid waste program? How much and what types of solid waste were collected during 1992? What were the MSW cost factors in Springfield, the energy consumed to run the program, and the total annual costs to run the program? Detailed description of Springfield's solid waste management program, the cost factors associated with that program, and the tonnage/costs associated with their MSW collection during 1992. Findings: Total FY 1992 cost (collection, transfer, hauling, processing, composting, disposal and marketing of recovered materials) was about $7.17 million, or an estimated $120/ton. Collection costs accounted for 39% of total costs; general and administrative expense was 16% of the total; and landfilling accounted for 7% of total costs. Energy consumed to manage garbage, bulky waste office paper, and recyclables was equivalent to a total of 11.9 gallons/ton.	3
National Renewable Energy Laboratory	1995	"Integrated Solid Waste Management of Sevierville, Tennessee" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Q: How has Sevierville, Tennessee implemented its solid waste program? How much and what types of solid waste were collected during 1992? What were the MSW cost factors in Sevierville, the energy consumed to run the program, and the total annual costs to run the program? Detailed description of Sevierville's solid waste management program, the cost factors associated with that program, and the tonnage/costs associated with their MSW collection during 1992. Findings: Total FY 1992 cost (collection, transfer, hauling, processing, composting, disposal and marketing of recovered materials) was about $1.09 million, or an estimated $106/ton. Collection costs accounted for 38% of total costs; the composting facility accounted for 32% of total costs; general and administrative expense was 9% of the total; and landfilling accounted for 19% of total costs. Energy consumed to manage municipal solid waste total of 18.44 gallons/ton.	3
National Renewable Energy Laboratory	1995	"Integrated Solid Waste Management of Palm Beach County, Florida" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Q: How has Palm Beach County, Florida implemented its solid waste program? How much and what types of solid waste were collected during 1992? What were the MSW cost factors in Palm Beach County, the energy consumed to run the program, and the total annual costs to run the program? Detailed description of Palm Beach County's solid waste management program, the cost factors associated with that program, and the tonnage/costs associated with their MSW collection during 1992. Findings: Total FY 1992 cost (collection, transfer, hauling, processing, composting, disposal and marketing of recovered materials) was about $101 million, or an estimated $144/ton. Collection costs accounted for 54% of total costs; general and administrative expense was 8% of the total; and landfilling accounted for 4% of total costs. Energy consumed to manage garbage, trash, and recyclables was equivalent to a total of 7.98 gallons/ton.	3
1.04 Existing SW Collection/Processing Infrastructure (Cont.)					
National Renewable Energy Laboratory	1995				3

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
		"Integrated Solid Waste Management: Six Case Studies of System Cost and Energy Use. A Summary Report" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Presents principal findings from case studies of integrated municipal solid waste management systems in Minneapolis, MN; Palm Beach County, FL; Scottsdale, AZ; Seattle, WA; Sevierville, TN; and Springfield, MA. Primary purpose of studies was to develop and present consistent cost, resource use, and environmental regulatory information on each system. Findings: The case studies "illustrate the decision-making advantages of examining program costs on an incremental basis"; that comparisons of average cost/ton of managing garbage to average cost/ton of diversion or resource recovery is inappropriate and can lead to mistaken conclusions; that when materials are diverted from the waste stream, local governments should determine if they can reduce costs for municipal solid waste collection and disposal; that high incremental costs do not necessarily mean a diversion or resource recovery program is not well-designed or operated; that collection costs are consistently that largest percentage of total system costs; that landfill disposal costs are a relatively small percentage of overall costs; that the added energy used to collect and process recyclables and yard waste is relatively small; and that waste diversion, recycling, and resource recovery programs tend to increase municipal solid waste management costs.	
Ohnesorgen, Frank	1993	"Sorting Out Solid Waste" *Public Management*	75 9-12	Case study identifying fundamental problems with SW management systems in Botswana, Costa Rica, Ecuador, Honduras, Morocco, and Swaziland. Common problems include: Too much service with corresponding strains on personnel and equipment; lack of "self-confidence" about service provision; local government corruption; lack of coordinated recycling effort; ignoring the value of composting; failure to recognize local opportunities; inconsistent cash flow.	3
Smith, Susan J. and Kathleen M. Hopkins	1992	"Curbside Recycling in the Top 50 Cities" *Resource Recycling*	(Mar.) 101-104	Q: Which of the 50 largest U.S. cities have curbside recycling programs, what materials are collected, and what entities collect the materials? Presents data from survey of recycling coordinators, community organizations, and recycling companies. Findings: 47 of 50 cities have recycling collection programs in place: 28 of these programs were operated by the municipality, 14 by private firms, and 5 by a combination of public and private operators. Most cities collect metals, old newspapers, and plastic bottles. Aluminum cans were the most common commodity in collection programs.	3
Wagner, T.C.	1991	"In Search of the Perfect Curbside System" *BioCycle*	(Aug.) 34-35	Q: What options are available to enhance curbside collection programs? Discusses pros/cons of the "bin versus bag" methods. Suggests local officials must choose the method best suited to their own needs, and that the search for "perfect" recycling systems continue.	2
Watson, Tom	1991	"Drop-offs on the Move" *Resource Recycling*	(Jan.) 48-55	Q: What are the benefits of mobile drop-off programs as alternatives to curbside and standard drop-off centers? Profiles programs in Pennsylvania, Florida, New Mexico, Wisconsin, and Newfoundland. Findings suggest benefits of lower cost than curbside programs, potential for community involvement, higher quality of collected materials, potential for use of more attractive sites, less stringent permit requirements, and opportunity to introduce recycling to an area. Disadvantages: limited collection capacity of vehicles, potential for materials to be left at site before/after hours, safety of volunteer workers, and restrictions on plastic collection due to volume limitations. Also suggests the value of this approach when curbside programs are not cost effective or traditional drop-off centers are unacceptable to the community.	3
1.04 Existing SW Collection/Processing Infrastructure (Cont.)					
Watson, Tom	1990	"Singapore: Recycling in a Southeast Asia City-State" *Resource Recycling*	(July) 102-105	Q: Are economic forces sufficient in themselves to encourage recycling? Case study of Singapore based on interviews with officials and private recycling operators. Findings: Singapore's government has taken limited policy action despite land and waste disposal facility shortages. Government's method of choice for waste disposal is incineration which includes emission controls, electricity generation, ferrous metal recovery. Waste reduction, recycling efforts have been initiated by the private sector. Market incentives function to encourage private recovery of ferrous metals, old newspapers, and corrugated containers, glass, scrap plastic, oil, old tires, and compost.	2

		Title	Vol./Edition	Description/	
Author (s)	Date	Publication Name	Pages	Findings	Use
Watson, Tom	1991	"The State of New York: Innovations, Funding Woes" *Resource Recycling*	(Jan.) 92-97	Q: Why and how has New York State confronted the need to recycle? Descriptive profile that details the motivation for, variety of programs to enhance, performance of, and anticipated challenges to recycling. Suggests that current activity is crisis driven, largely due to disappearing landfill space and limits of incineration and shipping garbage to other states. New emphasis on recycling and composting has created a situation of many needs and limited financial resources. Voters rejected increased funding measures, threatening existing programs and local governments implementing programs. Despite the state's leadership in recycling programs and market development, questions about public/political support present a questionable future.	2
Wells, Christopher	1991	"Brazil: The Morning After Industrialization" *Resource Recycling*	(Apr.) 71-75	Q: How have recycling programs evolved in Brazil? Case study describing evolution of recycling in Brazil as well as aggregate performance data. Article suggests there has been regional variation in the acceptance of recycling initiatives. Barriers to recycling include low income, low education. Opportunities include inexpensive labor costs, viable private markets in paper and paperboard, greater effect of financial incentives on lower income consumers. Also suggests that recycling in Brazil is a mix of First and Third Worlds: large volumes of recyclable waste are produced, but collection and separation channels are based on cheap labor. Regional culture will also influence acceptance of recycling. Further each communities' commitment to recycling is inversely proportional to participation in Carnival. "Metropolitan Rio, for example, still has no plans for curbside recycling collection programs, while the relatively sedate cities further south are expanding their recycling operations."	2

2.0 COMMUNITY AND ENVIRONMENTAL FEATURES RELATED TO RECYCLING OPERATIONS

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
2.01 Who Recycles and Why?					
Derksen, Linda and John Gartrell	1993	"The Social Context of Recycling" *American Sociological Review*	58 434-442	Q: What is the role of social context in the link between individual attitudes regarding environment and recycling behavior? Comparative analysis using survey data from the Province of Alberta, Canada. Sampling design divides province in three major areas: Edmonton (with a curbside recycling program), Calgary (with no recycling program), and the rest of the province (with no recycling program). Uses OLS regression to test four hypotheses: 1) There should be no significant relationship between individual concern for the environment and sociodemographic or recycling behavior variables; 2) Recycling levels should be low in areas providing little support for recycling; 3) Individuals with program access and higher environmental concern should recycle more; 4) Influence of social structural characteristics and individual characteristics should be strongest in communities with recycling programs. Findings: Analysis confirms that the strongest determinant of recycling behavior is access to programs making recycling easy and convenient. Social context has a strong, independent effect on recycling behavior, but on its own is insufficient to produce desired behavior. Environmental concern enhances effects of recycling programs, but does not overcome barrier presented by lack of access.	1
DeYoung, Raymond	1990	"Recycling as Appropriate Behavior: A Review of Survey Data from Selected Recycling Education Programs in Michigan" *Resources, Conservation and Recycling*	3 253-266	Q: To what degree do recycling education programs meet goals to increase public knowledge of waste reduction and recycling behaviors, develop positive attitudes about recycling behaviors, and encourage nonparticipating and participating households to increase recycling behavior? Uses data from six separate surveys of Michigan recycling education programs. Findings: Strong pro-recycling attitudes exist among sampled populations, and a significant number plan to increase recycling levels. Data suggest education efforts should focus on familiarizing people with how to recycle and to focus on non-monetary motives.	1
Feiock, Richard C. and Jonathan F. West	1993	"Testing Competing Explanations for Policy Adoption: Municipal Solid Waste Recycling Programs" *Political Research Quarterly*	46 399-419	Q: What variables influence a municipal government's choice to adopt curbside recycling programs? Employs probit analysis to assess influence of competing conceptions of municipal policymaking upon the choice to adopt recycling policies. Findings: Tests of the models revealed that six of seven competing explanations were related to policy adoption. Three - need, intergovernmental influence, and economic factors - were significantly related to municipal decisions to recycle.	1
Hopper, Joseph R. and Joyce McCarl Nielsen	1991	"Recycling as Altruistic Behavior: Normative and Behavioral Strategies to Expand Participation in a Community Recycling Program" *Environment and Behavior*	23 195-220	Q: To what extent is recycling altruistic normative behavior? To what extent can normative processes be shaped through interpersonal contact? What are the differing effects of communication techniques versus social techniques on participation? Employs pre- and post-experimental survey data. Findings: Data confirmed "that recycling behavior is consistent with...altruism, according to which behavior is influenced by social norms, personal norms, and awareness of consequences." Block leader programs in which residents urged neighbors to participate increased recycling behavior. Communications strategies (prompting and information) increased recycling behavior, but had no effect on norms and attitudes.	1
Hornik, Jacob; Joseph Chernian; Michelle Madansky; and Chem Narayana	1995	"Determinants of Recycling Behavior: A Synthesis of Research Results" *Journal of Socio-Economics*	24 105-127	Q: What factors serve as the best predictors of recycler behavior? Findings: Authors assess 67 empirical studies and classify consumer recycling behavior variables into four theoretical groups: "intrinsic incentives, extrinsic incentives, internal facilitators, and external facilitators." Using meta-analysis (A procedure in which results of quantitative studies are coded according to the direction of the empirical tests of factors influencing recycling behavior. The analysis, based on correlation, permits determinations of the relative strengths of simple correlations and, in this study, provides estimates of the strongest predictors of recycling behavior.) of the clustered variables,	1

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				findings suggest the strongest predictors of recycling behavior are internal facilitators, with external incentives being the next best predictors.	
2.01 Who Recycles and Why? (Cont.)					
Lansana, Florence M.	1993	"A Comparative Analysis of Curbside Recycling Behavior in Urban and Suburban Communities" *Professional Geographer*	45 169-179	Q: What factors contribute to household recycling participation rates? Using data from two communities, uses linear structural equations methodology (LISREL) to assess a causal model comparing resident demographic attributes, program awareness, environmental attitudes, and "overall" willingness to recycle. Findings: Results suggest that variation across communities is due mainly to differences in demographic characteristics and evaluation of program policies.	1
Matsuto, Toshihiko and Robert K. Ham	1990	"Residential Solid Waste Generation and Recycling in the U.S.A. and Japan" *Waste Management and Research*	8 229-242	Q: How does lifestyle affect the quantity/quality of waste across countries? Analysis of survey data from Madison, WI and Sapporo, Japan. Estimated household waste/recycling materials. Findings: Average Madison resident produced twice the paper waste and half the food waste of Sapporo residents, but approximately the same total quantity of waste.	1
Oskamp, Stewart; Maura J. Harrington; Todd C. Edwards; Deborah L. Sherwood; Shawn M. Okuda; and Deborah C. Swanson	1991	"Factors Influencing Household Recycling Behavior" *Environment and Behavior*	23 494-519	Q: What factors encourage or deter recycling? Findings: Most demographic, attitude and behavior variables did not predict participation in curbside recycling, while simple conservation knowledge did.	3
Saltzman, Cynthia; Vijaya G. Duggal; and Mary L. Williams	1993	"Income and the Recycling Effort: A Maximization Problem" *Energy Economics*	15 33-38	Q: Is there a theoretical rationale for the differing effects of income on recycling behavior? Specifies a model that incorporates recycling into the utility function, where utility is maximized subject to budget constraints. "The comparative statics of the model are then developed to derive theoretically the impact of income on the household recycling effort." Findings: The impact of household income is dependent on the household's ability to change the recycled proportion of a given product (*i.e.*, while the impact of income on newspaper recycling is expected to be consistently positive, it may be negative when the household has significant choice in the containers that suit their own recycling style.)	1
Shrum, L. J., Tina M. Lowrey, and John A. McCarty	1995	"Applying Social and Traditional Marketing Principles to the Reduction of Household Waste" *American Behavioral Scientist*	38 646-657	Q: What conditions contribute to greater attitude-behavior correspondence with regard to recycling and green buying? Presents overview of prior research, discusses social marketing principles, offers suggestions for applying findings to solve environmental problems. Suggests marketers need, as they do with any product, to figure out why ”what consumers say and do” doesn't always correspond.	1
Sudol, Frank J. and Alvin L. Zach	1991	"Newark's Curbside Recycling Program: A Participation Rate Study" *Resources, Conservation and Recycling*	5 35-46	Q: What are the participation rates in curbside recycling programs, and what is the nature of the items being recycled? Uses survey data collected in Newark, NJ over a 4-week period. Findings: Base participation was 37.7% of surveyed residents, with approximately 47% of participants recycling newspapers only, and 23% recycling bottles/cans only. Findings also reflect a positive relationship between income and participation and owner occupancy and participation.	3
			22		3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
Vining, Joanne and Angela Ebreo	1990	"What Makes a Recycler?: A Comparison of Recyclers and Nonrecyclers" *Environment and Behavior*		Q: Do recyclers differ from non recyclers? Survey of 119 Illinois households found recyclers were more knowledgeable about the why and how of recycling; nonrecyclers were more motivated by financial, convenience concerns; few demographic differences.	
2.02 Incentive Structures . . . Record of Performance					
Allen, Jeff; Duane Davis; and Mark Soskin	1993	"Using Coupon Incentives in Recycling Aluminum: A Market Approach to Energy Conservation Policy" *Journal of Consumer Affairs*	27 300-318	Q: What effect do coupon incentives have on consumer intent and behavior in recycling aluminum? Conducted a field experiment on a stratified sample of recyclers/nonrecyclers. Findings: Modest coupon incentives positively influence recycer's behavior, do not effect nonrecyclers. Coupon value is directly related to increased recycling frequency. Suggests value of coupon programs as a consumer incentive, a policy tool for increasing recycling frequency.	1
Alter, Harvey	1993	"Cost of Recycling Municipal Solid Waste With and Without a Concurrent Beverage Container Deposit Law" *Journal of Consumer Affairs*	27 166-186	Q: What are the effects of beverage container deposit laws (BCDLs) on the cost and amount of household MSW that is recycled? Author employs data, theoretical arguments from existing literature to retest GAO conclusions that BCDLs and curbside systems are more costly in combination than when alone, and that dual systems will be more cost-effective as landfill disposal costs increase. Findings: Communities with dual systems (BCDLs and curbside collection) have higher recycling costs; dual systems are not more cost-effective with increased landfill disposal costs. In communities with recycling programs, BCDLs do not contribute to diverting more waste from disposal.	1
Cuthbert, Richard	1993	"Variable Disposal Fees Reduce Waste" *American City and County*	(June) 47	Q: Do variable disposal fees enhance fund collection for disposal services and promote recycling and waste reduction? Descriptive report incorporates data from selected cities to illustrate positive effects of variable disposal fees. Suggests that few cities/counties have ability to quantify effects of fee increases on waste disposal or program funding. Case study findings suggest that "both variable curbside disposal fees (e.g., single can service rates) and quantity-based tipping fees (e.g., bag and tag fee systems) do assist and support waste reduction efforts."	3
Dinan, Terry	1992	"Solid Waste: Incentives That Could Lighten the Load" *Environmental Protection Agency Journal*	(May/June) 12-14	Q: What options are available to enhance household incentives to reduce waste? General presentation of factors contributing to societal costs of solid waste disposal, economic incentive options to change consumption patterns. Findings: Suggests the usefulness of household charges, combined disposal tax/reuse subsidies, and recycling credit systems.	3
Duggal, Vijaya G.; Cynthia Saltzman; and Mary L. Williams	1991	"Recycling: An Economic Analysis" *Eastern Economic Journal*	17 351-358	Q: What factors influence household incentives to recycle? Using 1980 socioeconomic data and recycling program data from 58 communities, authors used regression to test hypothesized influence of income, education, ease of recycling effort, time program has been in effect, number of items recycled, and financial benefit/penalty. Also ran separate equations to explain recycled material per household of newspaper and glass. Findings: Penalties for non-recyclers, number of items recycled, ease of recycling were insignificant influences, while education and program duration were significant in almost all equations. For glass, results suggest that once a week pickup (as opposed to bi-weekly collection) increases the amount recycled by about 23 pounds/household/year.	1
Fenton, R. and N. Hanley	1995	"Economic Instruments and Waste Minimization: The Need for Discard-relevant and Purchase-relevant Instruments"	27	Q: Can economic instruments contribute toward achievement of waste-minimization goals? Theoretical, rhetorical argument. Article suggests a conceptual framework categorizing economic instruments as purchase-relevant, discard-relevant, or jointly relevant. Argues the usefulness of considering purchase-, discard-, or joint-relevance of economic instruments for waste minimization policy. Also suggests need to mix strategy elements, identify target	1

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
		Environment and Planning	1317-1328	for action. Framework suggests that, while UK policy has emphasized consumer discard decisions, the use of other instruments holds greater promise.	
2.02 Incentive Structures . . . Record of Performance (Cont.)					
Grogran, Peter L.	1993	"Target Seattle" *BioCycle*	(Oct.) 82-83	Q: Is recycling working? Rebuttal to Wall Street Journal critique of Seattle's recycling/waste reduction programs. Clarification and presentation of aggregate data of program results. Contrary to critique, the article suggests city service costs are less expensive than traditional collection/disposal, with recycling contributing to reduced overall waste management costs; that combined recycling and trash collection service is less costly than trash only service; that active participation is higher than that reported by WSJ; and that there is an undersupply of many recyclable materials.	2
Harder, Greg and Linda Knox	1992	"Implementing Variable Trash Collection Rates" *BioCycle*	(Apr.) 66-69	Q: Have variable-rate systems improved upon performance of set-fee systems? Details rationale for variable rate systems, and survey data on 36 variable rate systems in Pennsylvania. Findings: Most common problem was inadequate dissemination of public information. Communities also found an increase in illegal dumping/backyard burning. While not all programs were successful, findings suggest that correcting for implementation errors can help cities reach diversion goals.	3
Hong, Seonghoon; Richard M. Adams; and H. Alan Love	1993	"An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Oregon" *Journal of Environmental Economics and Management*	25 136-146	Q: What are the influences of price incentives and other socio-economic factors on household recycling? Uses Portland, OR survey data in an ordered probit model of recycling participation, and two-stage least squares to estimate demand for solid waste collection. Findings: Increased disposal fees encourage recycling, but do not significantly reduce the demand for solid waste collection services.	1
Jenkins, Robin R.	1991	"Municipal Demand For Solid Waste Disposal Services: The Impact of User Fees" *Dissertation, The University of Maryland, Economics Department*		Q: Do waste disposal service user fees provide incentive to households to reduce discarded trash? Employs data from five "user fee communities" and four "non-user fee communities" in a utility maximization model to test household decisions regarding waste disposal and recycling. Independent variables include per capita income, prices received for recyclables, and employment levels. Findings: Results suggest significant influence of user fees on household/firm choice of waste disposal or recycling.	1
2.02 Incentive Structures . . . Record of Performance (Cont.)					
Jenkins, Robin R.	1993	"The Economics of Waste Reduction" Brookfield, VT: Edward Elgar Publishing Company			1

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
				Q: Do households reduce waste in response to user fees? How large is the welfare loss to society due to the absence of residential user fees? What factors explain the quantity of waste discarded by commercial establishments? Develops utility maximization model for the residential and profit maximization model for the commercial sector to assess data from five communities levying user fees and four cities that did not charge user fees. Findings: Results suggest user fees substantially contribute to reductions in the household solid waste stream, and that residential waste declines about 1% in response to a 10% increase in user fees. The analysis also suggests that a community decision to implement user fees will result in significant welfare gains (based on the average cost of solid waste disposal). Results indicate that the response of commercial establishments to user fees is greater than the response by households, and that increased commercial user fees are viable approach to prolonging landfill life. Author also suggests the value of the models for forecasting quantities of waste discarded by a community. Required data include the user fee for residential/commercial solid waste (for both residential and commercial model); average annual household income (for residential model); mean temperature in degrees Fahrenheit (for both models); total monthly precipitation in inches (for both models); average household size (for residential model); percent of population aged 18-49 (for residential model); population density (for both models); regional ONP price per short ton (for residential model); regional price for old corrugated containers (for commercial model); employment in the community (for commercial model); population (for residential model); CPI/100 (for residential model); and PPI/100 (for commercial model).	
Judge, Rebecca and Anthony Becker	1993	"Motivating Recycling: A Marginal Cost Analysis" *Contemporary Policy Issues*	11 58-68	Q: Does the quantity of household material diverted vary as a function of convenience factors and demographic characteristics? Conducted a controlled field experiment over a 6-month period to observe household recycling efforts. Material quantities were monitored under increasingly more convenient/more costly programs. Used TOBIT analysis to regress convenience factors, recycling education efforts, and demographic characteristics on the amounts of material diverted. Findings: Recycling behaviors differ significantly. Increased recycling convenience had the predicted effect on behavior; special education efforts had no measurable effect; and household size and educational attainment affect recycling effort. Using marginal analysis, program costs/household vary directly with program convenience. Suggests that considering only explicit cost/benefit of recycling ignores social importance; policymakers should weigh costs/benefits when designing recycling programs. Planners should consider marginal analysis to determine which program options should be offered to residents.	1
Menell, Peter S.	1990	"Beyond the Throwaway Society: An Incentive Approach to Regulating Municipal Solid Waste" *Ecology Law Quarterly*	17 655-739	Q: Are there policies that can systematically address the causes of the throwaway ethic? Uses an economic framework to assess a range of policy options to remedy the "distorted" incentives of the existing solid waste regulation system. Focuses on market interventions that will cause true disposal costs to be taken into account in public/manufacturer decisionmaking. Findings: While comprehensive monitoring systems have prohibitive costs, other economic incentive systems can be effective. Curbside charges and/or flexible systems of retail charges provide strong incentives for source reduction, material separation, and purchase of reusable/recyclable materials. Suggests federal/state/local roles to implement incentive-based systems.	3
Miranda, Marie Lynn	1993	"Managing Residential Municipal Solid Waste: The Unit-pricing Approach" *Resource Recycling*	(Nov.) 37-40	Q: What are the effects of unit pricing on waste diversion, landfilling, and source reduction? Analysis of survey data from 21 cities with unit-pricing programs. Findings: All cities reported reduced landfilling tonnage; unit-pricing programs coupled with aggressive recycling programs had larger decreases in landfilling; there was no significant difference in source reduction between high- and low-fee cities; cities with pre-existing recycling programs experienced 128% increase in material tonnage; there were no noticeable increases in burning or illegal dumping. Suggests unit-pricing provides incentive to source reduce and recycle, and may engender commitment to resolve MSW problems. Suggests avenues for further research.	3
2.02 Incentive Structures . . . Record of Performance (Cont.)					
	1994				1

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
Miranda, Marie Lynn; Jess W. Everett; Daniel Blume; and Barbeau A. Roy, Jr.		"Market-Based Incentives and Residential Municipal Solid Waste" *Journal of Policy Analysis and Management*	13 681-698	Q: Do market-based incentives improve the efficiency of residential solid waste management? Employs mail and phone survey data from 21 cities to test effects of unit-pricing programs on residential waste production. Findings suggest that unit pricing is an incentive for residents to reduce waste production and to increase recycling. Although recycling programs running concurrent with unit-pricing programs reduce incentives to reduce waste, data suggest that significant source reduction still occurs.	
Miranda, Marie Lynn; Scott D. Bauer; and Joseph E. Aldy	1996	"Unit Pricing Programs for Residential Solid Waste: An Assessment of the Literature" *School of the Environment, Duke University, Durham, North Carolina*	33 pages	Q: To what degree do unit-pricing programs accomplish stated goals? Analysis of academic/professional literature. Findings: Unit pricing results in increased recycling participation and may be an incentive for source reduction. It is fairer to those producing less garbage; may provide aesthetic benefits; may contribute to undesirable diversion and waste compaction; adversely impacts low income residents and multi-unit housing residents. Suggests MSW managers implementing unit-pricing programs may want to consider system specifications; design of the rate structure; problems with illegal disposal and fee impacts on low income residents; degree of public/political support; and the need for education and enforcement mechanisms.	3
Morris, Glenn E. and Denise C. Byrd	1990	"Unit Pricing for Solid Waste Collection" *Popular Government*	56 37-44	Q: What are the advantages/disadvantages of unit-pricing schemes? What is the record of unit-pricing programs in the communities they serve? Findings: Effects of unit-pricing programs depend on both community and program features. Examination of 16 programs found high customer acceptance, with bag programs encouraging intended reductions in the waste stream and increased recycling. Higher prices do tend to modify waste behavior.	3
Morris, Glenn E. and Duncan M. Holthausen, Jr.	1994	"The Economics of Solid Waste Generation and Disposal" *Journal of Environmental Economics and Management*	26 215-234	Q: Does better understanding of the economics of household waste management offer a better basis for assessing impacts of solid waste management policy? Developed a theoretical model of household choice that reflects key purchase, processing, and disposal options. Findings: Model simulation reveals that household response elasticities can vary across price ranges, and that large household "welfare gains" may result from adoption of curbside recycling and unit pricing programs.	1
Powers, Kathleen J. and Fred Thompson	1994	"Managing Coprovision: Using Expectancy Theory to Overcome the Free-Rider Problem" *Journal of Public Administration Research and Theory*	4 179-196	Rhetorical argument and case study to support value of expectancy theory in designing/organizing service delivery that promotes coproduction (such as recycling programs). Expectancy theory stresses the importance of citizen understanding of what is expected of them, what is required to fulfill those expectations, and an incentive to participate. And it requires an inclination of public employees to encourage citizen contribution and effort in service provision, and to structure service provision to reduce administrative complexity, and decentralize controls.	3
Repetto, Robert; Roger C. Dower; Robin Jenkins; and Jacqueline Geoghegan	1992	"Green Fees: How a Tax Shift Can Work for the Environment and the Economy" Washington, DC: World Resources Institute		Q: Can "green fees" (e.g., charges on pollution, waste, and congestion) produce a cleaner environment, reduce economic disincentive of the current tax system, and strengthen the economy? Develop an empirical demand model to assess potential economic savings from taxes in the form of pay-by-the-bag household solid waste collection charges, rush-hour tolls, and carbon taxes. Present detailed argument for potential gains of shifting revenue burden from economic "goods" to environmental "bad"; the nature of green fee incentives, and estimated cost savings for each of the suggested tax programs. Findings: In addition to benefits of reducing amounts of solid waste for disposal, highway congestion and in pollution, and carbon dioxide emissions, authors estimate these taxes could "yield at least $100 billion in annual revenues for federal, state, and local governments.	
2.02 Incentive Structures . . . Record of Performance (Cont.)					
Reschovsky, James D. and Sarah E. Stone	1994	"Market Incentives to Encourage Household Waste Recycling: Paying for What You Throw Away" *Journal of Policy Analysis and Management*	13 120-139	Q: How does quantity-based pricing of SW disposal affect household recycling behavior? Uses random survey data from one upstate New York county to examine effects of quantity-based pricing when used by itself or in combination with curbside pickup or mandatory recycling laws. Findings: Policy combinations that include curbside recycling are most effective. Suggests intrinsic returns of recycling are important; further research is needed to estimate private and public costs of SW disposal, reduction.	1
					3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
Rousso, Ada S. and Shevtank P. Shah	1994	"Packaging Taxes and Recycling Incentives: The German Green Dot Program" *National Tax Journal*	47 689-701	Q: What are the policy effects of the "polluter pays" principle in Germany's Green Dot Program? Case study presenting the underlying rationale, mechanics, financing, and results of this program, with a brief comparison to other European initiatives. Results suggest the viability of policies to shift economic costs from public waste management systems to the private parties creating the waste.	
Skumatz, Lisa A.	1993	"Introducing the Hybrid Variable Rate System" *BioCycle*	(Nov.) 38-40	Q: Can hybrid rate options counter community resistance to variable rates due to concerns over convenience, implementation costs or revenue recovery? Discusses pros/cons of traditional variable rate systems (cans, bags, stickers, weight based). For communities unable to face the risks of these traditional options, suggests advantages of an evolving 'hybrid' system where base levels of service are funded through property taxes or fixed fees and increments are paid through a variable rate basis such as bag or sticker systems. Presents data from three communities implementing this hybrid approach. Suggests the hybrid system may well serve communities through a price incentive to reduce waste generation/increase recycling quickly and with reduced risk.	3
Skumatz, Lisa A.; Hans VanDusen; and Jennie Carton	1994	"Ready to Roll With Weight Based Fees" *BioCycle*	(Nov.) 76-79	Q: What is the potential for 'billing by weight' systems. General presentation of arguments for and against volume-based pricing versus weight-based billing, and discussion of survey findings from four weight based pilot programs. Findings suggest: 1) Seattle's pilot program led customers to reduce garbage set-outs by 15%. 2) New technologies tested in Columbia, SC, Durham, NC, and British Columbia hold promise (sensors to automate billing data, accurate scale systems, equipment to simultaneously weigh, and collect three different waste streams.)	2
Stone, Sarah and Ellen Harrison	1991	"Residents Favor User Fees" *BioCycle*	(Aug.) 58-59	Q: What are the results of combined trashtag/curbside recycling programs? Analysis of survey data from households in Tompkins County, NY, soon after implementation of programs. Findings: Residents overall felt favorable to the trashtag program, and want increased disposal costs to be reflected in higher trashtag fees. Half of the respondents claimed to recycle more after implementation of the trashtag program. Respondents also indicated increased effort in composting and attention to packaging. Results suggest merits of user-fee systems.	3
Vining, Joanne and Angela Ebreo	1992	"Predicting Recycling Behavior from Global and Specific Environmental Attitudes and Changes in Recycling Opportunities" *Journal of Applied Social Psychology*	22 1580-1607	Q: What effects does availability of curbside recycling programs have on recycling behavior and attitudes? Longitudinal data from household surveys in one community are used to assess changes in environmental concern, recycling attitudes, and recycling behavior as recycling opportunities were increased over time. Findings: Over time, proportion of recycling households increased as did volume of recycled materials. General environmental concerns and specific attitudes toward recycling also became more favorable over time. Results suggest that maintaining recycling behavior and encouraging other conservation activities may be more influential than forcing initial compliance.	1
2.02 Incentive Structures . . . Record of Performance (Cont.)					
Wang, Theodore H. and Richard D. Katzev	1990	"Group Commitment and Resource Conservation: Two Field Experiments on Promoting Recycling" *Journal of Applied Social Psychology*	20 265-275	Q: What are the relative impacts of commitment and incentive-based efforts to promote resource conservation? Uses data from two experiments to compare the relative impact of commitment and incentive-based strategies to promote recycling. Experiment 1 evaluated the effect of group commitment procedures, while Experiment 2 focused on individually pledged commitments. Findings: Subjects in the group commitment cohort (Experiment 1) recycled 47% more paper than during baseline, and continued at this level for 4 weeks after the commitment was removed. The test group in Experiment 2 recycled 3 to 5 times as much material as the control groups, but when treatments were removed, only individually committed subjects continued to recycle significantly more than controls.	1
Ward, James D.	1995				1

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
		"Exploring the Implementation of Solid Waste Recycling Programs" *International Journal of Public Administration*	18 659-673	Q: Do collection mechanisms influence participation rates? Do recycling service fees impact participation? Analysis of survey data from four states. Examines mandatory versus voluntary programs, and controls for in-house versus privatized and fee versus no-fee programs. Findings: Voluntary-fee programs approximate mandatory programs, while independent voluntary-fee mechanisms revealed the lowest participation rates. Length the program was in effect contributes to greater awareness and support. There was no significant difference between in-house versus privatized program participation rates. Suggests that recycling studies need to include voluntary program characteristics for better understanding of compliance variations and methods to enhance participation. Researchers need to assess influence of regional political culture.	
Yuhas, Barbara and Jennifer Hyde	1991	"Getting Multi-family Residents into the Act" *Solid Waste and Power*	(June) 54-60	Q: How can communities provide means of recycling to all residents, and help meet mandated goals? Case study of Prince George's County, MD program to implement apartment recycling. Impetus stemmed from 1989 county recycling law requiring multi-unit property owners to provide opportunities for tenants to recycle. County offered owners guidance in planning and recycling manual preparation; provided owners with information to set up their programs; educated owners and residents; encouraged formation of recycling committees; and established grants to help owners cover capital goods purchases. In lieu of unreliable participation rate data, early data based on county surveys and contractor records of recyclable generation rates suggest: 1) Strongest influences on generation rates were management interest in recycling, convenience to the residents, socio-economic factors, and resident organization. 2) Program costs translate to $5 to $6 per unit per month, largely due to labor and collection frequency.	3
2.03 Public Participation in Program Design/Operation					
Folz, David H.	1991	"Recycling Solid Waste: Citizen Participation in the Design of a Coproduced Program" *State and Local Government Review*	(Fall) 98-102	Q: Does citizen involvement in recycling program planning and design contribute to higher citizen participation? Analysis of national mail survey of municipal recycling coordinators. Findings: Participation in recycling programs is significantly higher in municipalities that stress citizen involvement in recycling program planning and design.	3
Fox, Gerald G.	1991	"Building Support for Environmental Initiatives" *Public Management*	73 7-9	Case study specifying method used in Mecklenburg County, NC's approach to building public support for its integrated solid waste management program. Suggests five rules to build and maintain public support: 1) prepare for all possible outcomes and publicly address issues, 2) follow a written action plan, 3) anticipate who and what groups will be affected and make every effort to get them involved, informed; 4) identify the range of possible responses and reactions to proposal, and be proactive; and 5) anticipate the "opportunities and vulnerabilities" of plan.	3

3.0 MATERIALS PROCESSING AND MARKETING

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
3.01 Problems, Challenges					
Grogan, Peter L.	1993	"Policy Options for Market Development"	(July)	Q: What policy options are available to improve end-use markets and increase waste diversion? Presents proposals of the National Recycling Coalition Recycling Advisory Council. Options suggested include: 1) tax imposed on virgin materials in product manufacturing/packaging; 2) minimum content standards for use of	3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
		BioCycle	34	recovered materials in products/packages; 3) material specific utilization requirements; 4) making producers and consumers responsible for package recycling; 5) "take-back" programs making manufacturers responsible for developing the complete infrastructure for collection, processing, and end-use markets; and 6) creation of a national secondary materials trust fund to promote use of recyclable commodities.	
Powers, Roger W.	1995	"Curbside Recycling: Energy & Environmental Considerations" *Solid Waste Technologies*	(Sept./Oct.) 32-40	Q: Does recycling save energy? What are recycling's environmental emissions? Analysis of national Keep American Beautiful study to quantify energy and environmental effects of the four waste management strategies ("recycling, composting, waste to energy, and landfilling"). Uses Life Cycle Inventory technique to quantify results for given products/systems. Findings: Strategies using composting and recycling reduced landfilling and saved energy. The more comprehensive the recovery system, the greater the energy savings. Suggests that systems combining strategies produce the greatest net benefits. Energy and environmental effects of curbside recycling occur both at the curb and at often distant remanufacturing plants, while composting and waste-to-energy facilities are usually located near the site of waste generation.	3
Roy F. Weston, Inc., and The Solid Waste Management Association of North America	1995	"Environmental, Economic, and Energy Impacts of Materials Recovery Facilities" Report Prepared for the U.S. Department of Energy. Springfield, VA: National Technical Information Service		Q: What are the environmental, economic, and energy implications of Material Recovery Facilities (MRF's)? Performed a comprehensive evaluation of six MRF's geographically distributed across the country, that received both commingled and separated wastes, and used various techniques to recover recyclables with the primary purpose of understanding the effects of MRF operations on public health, the environment, and on occupational health and safety. Study considered the economic and energy aspects of MRF's; impacts on air quality, receiving waters and community noise levels; and chemical exposure, biological aerosols, occupational noise, physical safety, and ergonomics. Findings: All six MRF's presented a net cost to their respective integrated municipal solid waste management systems. Costs and revenues were dependent on a number of variables, including collection practices, facility design, market availability, and contractual arrangements. Energy consumption/ton of waste handled was higher for recyclables compared with solid waste. MRF's do not seem to pose a threat to public health or the environment. Health and safety hazardous can be controlled by design and implementation of OSHA worker protection programs.	3
3.02 Local Government Practices . . . Technical Aspects					
Cummings, Mary Leffler	1991	"The State of the State: Recycling in Florida" *Resource Recycling*	(May) 32-38	Q: How has Florida worked to achieve its recycling goals? Details key features of Florida's 1988 Solid Waste Management Act including methods for data collection, goal determination, funding, dealing with special wastes, providing for public education, and development of regulations, procurement procedures, market development, and intergovernmental cooperation.	3
Gainer, Margaret	1991	"Recycling Entrepreneurship: Local Markets and Economic Development" *Resource Recycling*	(Feb) 48-51	Q: What are some of the creative approaches being used to strengthen market conditions for recyclables? Suggests presence of mutually beneficial opportunities for local governments and business. Cites a consulting group report outlining recycling market development strategy, and a model for encouraging local small-scale enterprises as end use markets. Includes case studies of small-scale manufacturers using recycled materials.	2
Powell, Jerry	1990	"The State of the State: Recycling in New Mexico" *Resource Recycling*	(Nov.) 54-58	Q: How has New Mexico overcome barriers to recycling? Presents examples, details of private and public efforts to implement recycling services. Suggests that public and legislative interest, private incentives, and government initiative and funding can overcome the barriers of small population, vast size, low disposal rates, and remoteness from recycling markets.	2
3.03 Legal Vehicles . . . In-House, Contracts, Cooperative Agreements, Regional Associations					
Apotheker, Steve	1993	"State and Provincial Recycling Associations Mature"	(May)	Q: What is the status of recycling organizations in the face of economic challenges, reduced growth in development of recycling collection programs? Discussion, data from survey of 38 state and five provincial	3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
		Resource Recycling	35-41	recycling organizations. Findings: Two groups were added to prior year totals, but overall membership declined 6%; budgets increased, indicating an ability to increase services, and attract other funding sources; the top policy priority for recycling organizations is market development.	
Apotheker, Steve	1992	"State and Provincial Recycling Organizations Get Busy" *Resource Recycling*	(May) 50-59	Q: What are key characteristics and activities of evolving state and provincial recycling organizations (ROs)? Presents data (comparative and aggregate) from 1992 survey of 36 state, 5 provincial ROs. Tables detail membership growth; membership and financial features of ROs; and staffing and membership services provided by ROs. Findings: There was a 50% increase in membership over three years. ROs represent the majority of recycling professionals/activists, but have not focused their expertise, political power; resources tend to be used for more services for more members. Almost all ROs offer newsletters, conferences to members. Two-thirds are involved in advocacy at the state or provincial level, take part in major events, keep member directories, provide technical assistance, and conduct seminars/workshops. Over 80% of state ROs have, or plan to be, affiliated with the National Recycling Coalition.	3
Aunan, Lauri and Tom Martin	1994	"Recycled Content Laws: How Are They Working?" *Resource Recycling*	(May) 30-36	Q: How and at what cost are states implementing Recycled Content Laws (RCLs)? Are affected parties complying with RCLs, and are RCLs being enforced? What are the measurable results of RCLs? Summary of National Environmental Law Center survey/interview research. Findings: RCLs are fairly simple to implement, cost ranges between $500-$83,000/year. Affected companies tend to comply. Officials do think RCLs lead to improved markets for post-consumer materials.	3
Becker, Jeanne and April Richards	1992	"Zoning for Recycling" *Resource Recycling*	(Mar.) 80-85	Q: Does community use of zoning ordinances "minimize negative land use impacts associated with recycling facilities"? Describes the various types of recycling facilities, and the impacts and concerns sometimes associated with them. Compares regulations used in several municipalities. Article suggests that zoning ordinances that permit recycling facilities in certain zones and include appropriate regulation of such facilities will limit conflicts–all facilities function as an important part of the community.	3
Burt, Justine and Patricia Dillon	1994	"What the US Can Learn From Germany's Packaging Take-Back System" *Resource Recycling*	(Sept.) 87-89	Q: Can U.S. MSW policy benefit from packaging take-back programs? Discusses performance of German Ordinance on the Avoidance of Packaging Waste, and suggests applicability to U.S. policy. Article suggests German program has shown value of including environmental costs in the product price to alter industry behavior and to develop demand-side of the recycled product market. Findings suggest the system is a less expensive option than landfilling or incineration; that making companies responsible for their products from design to disposal is an efficient/effective tool to enhance source reduction/recycling; has not achieved adequate market demand for recycled materials. Also suggests that U.S. can learn that by internalizing externalities of disposal methods, recycling can be cost-effective, and manufacturers should bear some responsibility for their share of the garbage; finally suggests that U.S. needs to develop demand side of the market.	3
Johnson, Holly J. and Mary G. Kohrell	1992	"Trends in Cooperative Marketing of Recyclables" *Resource Recycling*	(Sept.) 41-47	Q: What is the status of cooperative marketing? Summary of results of a survey of existing cooperative marketing programs. Findings: Cooperative marketing is being established in both rural/urban environments with no predictable size/population. The public sector outweighs private membership; most programs began after 1990; and most are incorporated as non-profit entities. State and EPA grants are the most common funding source.	3
3.04 Material Prices, Trends, Instability, and Predictability					
Apotheker, Steve	1993	"It's Black and White and Recycled All Over" *Resource Recycling*	(July) 36-44	Q: What is the current/projected status of supply/demand for old newspapers (ONP)? Analysis of 1988-92 market data. Findings: Over five years, ONP recovery rate increased from 35% to 55%; ONP export levels have increased at slower rates since 1989; spotty price changes are due to higher regional demand by U.S., Canadian mills; purchase of inexpensive northern ONP for Southeastern markets; and flattening of the export market. Better technology, export markets are expected to contribute to better supply/demand balance in 1993.	2
Dinan, Terry M.	1992				1

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
		"Implementation Issues for Marketable Permits: A Case Study of Newsprint" *Journal of Regulatory Economics*	4 71-87	Q: Are potential efficiency gains of a marketable permit system for newsprint likely to increase demand for old newspapers (ONP)? Findings: Marginal cost equations support suggestions that marketable permit systems will contribute to a successful market for ONP.	
Kashmanian, Richard M.; Trisha Ferrand; Andrew Stoeckle; and Tapio L. Kuusinen	1990	"Source Reduction and Recyclability: Recent Marketplace Activities" *Resource Recycling*	9 84-89	Q: What options are available to promote source reduction and recyclability in the marketplace? Analysis of various public opinion poll responses relevant to the question. Findings: There is a need to improve the image of recycled materials to attract new markets, the reputation of recycled goods among consumers and industry, and cost incentives to purchase recycled products as opposed to less-expensive virgin material products. Other activities include: Capitalizing on public awareness; cause-related marketing; environmental shopping programs; letter-writing campaigns; and product/packaging labeling.	3
Klein, Yehuda L. and H. David Robinson	1993	"Solid Waste Disposal Costs, Product Prices, and Incentives for Waste Reduction" *Atlantic Economic Journal*	21 56-65	Q: What are the impacts of solid waste disposal costs on product prices? Uses standard input-output method to assess impact of SW disposal costs on product prices during 1977, 1982, and 1985. Findings: Results confirm that rising waste disposal costs lead firms to reduce their waste stream.	1
Kohrell, Mary and Gary J. Olson	1990	"What's the Future of Cooperative Marketing?" *Resource Recycling*	(June) 34-37	Q: What is the future of cooperative marketing of recyclables, and is it the solution to market glut problems? Discussion of the growth in cooperative marketing of recyclables, five steps to evaluating the feasibility, planning and implementing programs. Suggests potential of cooperative marketing has been largely untapped, but influence of private sector competition, local government competition will have unknown impacts.	3
Martin, Russ	1994	"Improving Recycling Through Market Forces" *BioCycle*	(Oct.) 75-77	Q: Do advanced disposal fees enhance recyclable markets? Details the 1993 Florida program that set goals for sustained recycling rate, recycled material content, and takeback provisions to give competitive advantages to companies meeting those goals. Findings: Florida's ADF has stimulated demand for recovered materials; has set goals that increase over time and incorporates some flexibility for companies trying to meet those goals; helps show consumers that some products have higher environmental costs than others.	3
Misner, Michael	1991	"Six Months of Recyclable Prices Show Market Instability" *Waste Age*	(Sept.) 36-44	Q: What factors contribute to recycling market instability? Tracks price trends of several materials over a 6-month period in 1991. Findings: Uncontrolled market forces of "supply and demand, world events, and macroeconomic effects...can rapidly change the value of any recyclable." Data include average prices paid over six months for aluminum UBC's, clear glass, paper, and PET and HDPE plastic.	2
Moore, Bill	1995	"Increasing Supply: What's the Paper Industry Doing?" *Resource Recycling*	(Nov.) 63-68	Q: What is the status of the recovered paper supply market? Discussion of key elements of recovered paper market, processing, and supply/demand. Suggests long-term recovered paper supply market is healthy, but that the supply network must increase tonnage before the paper industry will make the needed investment to add new recycled capacity.	2
Powell, Corey S.	1990	"Plastic Goes Green" *Scientific American*	(Aug.) 101	Q: How have economic, political forces influenced the plastics recycling market? Discussion, presentation of aggregate data about the status of the plastics recycling market. Suggests demand for recycled plastic has and will continue to outstrip supply. In response, industry is tapping into the market, and manufacturers are responding with more use of recycled plastics. Obstacles include public misperceptions of plastic materials, processing problems, and material bulk that increases transportation costs.	3
3.04 Material Prices, Trends, Instability, and Predictability (Cont.)					
Sutherland, Greg; Dan Cearley; and Marc Tormey	1995	"Market Prices for Recyclables: A Five-year History" *Resource Recycling*	(Aug.) 51-60	Q: What is the five-year trend for recyclables recovery and prices? Presents the R.W. Beck Recycling Markets Index of overall recycling market indicators for 10 major recyclable materials. Findings: 1994 was the first year in many that showed an upturn in market prices reflecting a basic change in industry use of recovered materials and a healthy economy permitting companies to recapture high raw material costs in prices for finished products.	3

4.0 RECYCLING PROGRAM FINANCES

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
4.01 Problems, Challenges					
Beede, David N. and David E. Bloom	1995	"The Economics of Municipal Solid Waste" *The World Bank Research Observer*	10 113-143	Q: What are the future implications of current trends, practices, and policies in generation and management of solid waste? Uses economic rationale, data analysis, and review of literature to make three points: 1) While a great deal of MSW is collected and disposed of through controlled programs, much of the remainder is openly burned or dumped. Authors suggest that improvements in hazardous waste handling now will be less expensive than "undoing in the future the damage to the environment and to human health caused by current practices;" 2) Some solid waste resource value is being captured by informal scavenging and recycling in the developing world, and some through community-sponsored recycling, waste-to-energy, composting programs; 3) "Because the benefits of solid waste disposal extend beyond the households and firms that incur the costs, community intervention may promote the social good."	3
Earle, Ralph III	1990	"Northeast Promotes Recycling Markets" *Journal of State Government*	(March/ April) 64-66	Descriptive report on the market and economic forces encouraging formation of the Northeast Recycling Council. Emphasis on need for states to develop markets for recycled goods through use of economic development, regional cooperation, innovative environmental management, and government/industry partnerships.	2
Kirkpatrick, David	1995	"What do Recycling Businesses Want and Need?" *Resource Recycling*	(June) 23-26	Q: What is the recycling industry contribution to state employment, and what are their capital demands and technical assistance needs? Summarizes findings of the North Carolina Recycling Business study. Findings: In 1994, there were an estimated total of 8,700 recycling jobs; inadequate financing is the main obstacle to recycling business growth; more than one-third of companies suggested a need for expanded business or technical assistance. Suggests the rapid growth in recycling, reuse, composting, and manufacturing companies largely spurred by state and local laws/programs. States need to nurture the growth of recycling industry with such options as capital access, technical/business assistance, stable regulatory environment.	3
Kriz, Margaret E.	1992	"Recoup d'Etat" *National Journal*	19 1116-1120	Wide ranging report on the relatively new approaches being considered at the federal, state, and local levels to shift a greater portion of recycling costs onto U.S. consumer product companies.	2
4.02 Local Government Practices					
Bauer, Scott and Marie Lynn Miranda	1996	"The Urban Performance of Unit Pricing: An Analysis of Variable Rates for Residential Garbage Collection in Urban Areas" *Prepared for: Office of Policy, Planning and Evaluation, Environmental Protection Agency*		How does unit pricing for MSW collection perform in large urban areas? What issues are important to these communities? Findings: Unit pricing increases recycling diversion. Unclear effect on source reduction.	3
Cuthbert, Richard	1994	"Variable Disposal Fee Impact" *Biocycle*	(May) 63-65	Q: What are the measurable effects of variable fee systems in place for at least one year? From 1993 survey data, presents anecdotal information from six communities to assess effectiveness of fees in promoting waste reduction. Findings: Variable curbside disposal fees do help and support waste reduction efforts. Effects depend on social, demographic, and economic variables. Variable disposal fees are generally well accepted by the public, and support other waste reduction activities.	3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
4.02 Local Government Practices (Cont.)					
Moriarty, Patrick J.	1994	"Financing Waste Collection for Maximum Diversion" *BioCycle*	(Jan.) 66-68	Q: Can financing methods impact the success of recycling programs? Analysis of survey data from 23 Cook and DuPage County, IL municipalities. Findings: Pay-per-bag systems are the best of the methods surveyed to divert waste from landfills without imposing tax burdens on citizens. Flat fee systems lack incentives to recycle.	3
4.03 Cost Elements of Curbside, Drop-Off, and Buy-Back Operations					
Deyle, Robert E. and Bernd F. Schade	1991	"Residential Recycling in Mid-America: The Cost Effectiveness of Curbside Programs in Oklahoma" *Resources, Conservation and Recycling*	5 305-328	Q: What is the relative cost-effectiveness of curbside recycling versus land disposal systems? Use 20-year net present value analysis to assess cost-effectiveness. Findings: Curbside recycling may be marginally cost-effective under favorable conditions. Low land disposal costs limit impact of avoided costs. Suggest that achieving RCRA goals will require recycling of materials other than those amenable to curbside recycling.	1
4.04 Methodologies for Determining/Evaluating Program Costs					
Atri, Said and Thomas Schellenberg	1995	"Efficient Management of Household Solid Waste: A General Equilibrium Model" *Public Finance Quarterly*	23 3-19	Q: Can a more efficient incentive system be devised to enhance solid waste disposal and recycling? Findings: Authors develop a system of Pigouvian taxes and government-mandated refunds as a more efficient alternative to existing schemes relying on volume-based fees and/or lump sum taxes and employ a dynamic general equilibrium model to illustrate that tax/refund incentives are more efficient, and suggest methods for implementation.	1
Carroll, Wayne	1995	"The Organization and Efficiency of Residential Recycling Services" *Eastern Economic Journal*	21 215-225	Q: Do recycling costs differ significantly between municipal, private-contract, and market-based programs? Analysis incorporated grant application, program details obtained through telephone survey, and census data of 57 Wisconsin cities with curbside recycling programs in 1993. Used regression analysis to assess hypothesized influences on average (net) recycling costs per household. Findings: Residential recycling costs are a decreasing function of population density and are higher with municipal collection than with private-contract collection. Scale economies (e.g., population) and collection frequency do not appear to be important influences on per household recycling costs.	3
deKadt, Marten	1992	"Evaluating Recycling Programs: Do You Have the Data?" *Resource Recycling*	(June) 28-36	Q: What are the problems associated with comparing recycling program data? Examines problems posed by data compiled using different definitions and methodologies, and representing waste streams with different compositions. In comparing Islip, NY and Somerset County, NJ, findings suggest that published recycling rates do not evaluate either the scope or effectiveness of recycling programs; lack consistent, standard, and meaningful terminology; lack standardized data. Findings suggest comparisons have little validity unless data can be manipulated to reflect similar waste streams. Standardized data collection categories are needed, desegregated data are essential.	3
Fullerton, Don and Thomas C. Kinnaman	1995	"Garbage, Recycling, and Illicit Burning or Dumping" *Journal of Environmental Economics and Management*	29 78-91	Q: Should garbage be taxed to reflect its negative externality, or subsidized to avert illicit dumping? Should recycling be subsidized or would taxing virgin materials have the same effect? What is the effect of deposits on purchases and refunds on returns? Authors employ a general equilibrium model of household choice to test hypothesized influences of consumption versus leisure, and the options of garbage/recycling and illicit burning or dumping. Findings suggest an optimal deposit-refund fee structure equal to the direct resource cost plus external environmental cost.	1
4.04 Methodologies for Determining/Evaluating Program Costs (Cont.)					
Huhtala, Anni Hannele	1994				1

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
		"Is Environmental Guilt a Driving Force? An Economic Study on Recycling" *Dissertation, University of California at Berkeley*		Q: What is a socially optimal level of recycling to ease resource scarcity, pollution and waste accumulation problems? If consumers' "greening" preferences are accounted for in monetary terms, will this affect adoption of waste management policies? Develops a materials balance framework to suggest that by recycling, "it is possible for an economy to achieve a steady state where both resource and waste stocks are kept constant." Uses data from a case study in the Helsinki region in Finland to assess people's willingness to pay for waste management options. Examines "how to allocate available and future landfill capacity over space in a socially optimal way when recycling was considered." Results suggest that people favor recycling over incineration, and that landfilling becomes a more costly disposal option relative to other options. Generally, findings suggest recycling is "both economically and environmentally justified."	
Hyde, Jeff and Stephen B. Lovejoy	1995	"Recycling: The High Cost of Being Environmentally Correct" *Staff Paper, Department of Agricultural Economics, Purdue University*	11 pp.	Q: Are there economies of scale in the refuse/recycling markets? What are the effects of privatization? Analyzes survey data from 209 Indiana cities and towns. Findings: Per-household costs from recycling are higher than per household revenue generated. Privatization reduces per household costs related to recycling. Scale economies exist in both recycling and refuse services. Suggest that unquantified benefits of recycling compared to benefits of other environmental improvement programs should be part of each community's decision-making process.	3
Johnson, Margit and William L. Carlson	1991	"Calculating Volume-based Garbage Fees" *Biocycle*	(Feb.) 48-50	Q: How should garbage fees be calculated? Suggests that correct fee calculation requires accurate measures of garbage generated by each household. Measures may vary with hauler's equipment, level of service, billing system, or other local factors. Suggests that a measurable/workable fee structure for haulers and customers may be coaxed from such typical measurement models as: 1) actual weight of garbage, 2) variable cans or bags, 3) pre-paid bags, or 4) pre-paid stickers/tags. The challenge to communities is to provide a fair return to haulers at minimum cost to the public.	2
Lund, Jay R.	1990	"Least-Cost Scheduling of Solid Waste Recycling" *Journal of Environmental Engineering*	116 182-197	Q: How should recycling efforts be selected and scheduled over time to minimize total present value cost of recycling and of landfill operation, closure, and replacement? Author designs and evaluates a series of linear programs to determine the least-cost schedule of recycling efforts and the least-cost landfill lifetime. Findings suggest the value of economic and optimization theory to assess and design recycling efforts, and the need for better identification of recycling measures.	1
Perkins, Ron	1991	"Collection Economics for Plastics Recycling: A New Methodology" *Resource Recycling*	(May) 66-69	Q: How can plastic collection costs be equitably distributed? Presents results of collection efficiency analyses of 18 curbside recycling collection programs. Suggests cost variations due to number of materials collected, number of curb separations performed, collection frequency, crew size, type of truck used, and unspecified qualitative parameters. Suggests a cost-allocation method that distinguishes between collection costs attributed to a specific material and costs that are systemic and must be allocated to all materials. Findings suggest that available technology and market prices can keep costs of collecting plastic consistent with other materials.	3
4.05 Public Versus Private Sector Risk Assumption					
Dobbs, Ian M.	1991	"Litter and Waste Management: Disposal Taxes versus User Charges" *Canadian Journal of Economics*	24 221-227	Q: Can Pigouvian tax/price solutions correct depletable or undepletable externalities of litter and waste management? Employs a market model to assess the divergence between the private and social costs of littering and trash collection. Findings suggest the need to consider these problems jointly. Separately, user charges for trash collection have been promoted to internalize waste management externalities, but viewed as part of a larger problem, these charges may be negative. Suggests that refunds or user subsidies should be associated with proper trash disposal.	1
4.05 Public Versus Private Sector Risk Assumption (Cont.)					
Environmental Protection Agency	1990				3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
		"Charging Households for Waste Collection and Disposal: The Effects of Weight- or Volume-Based Pricing on Solid Waste Management" *Research Triangle Institute report prepared for the Environmental Protection Agency*		Q: Does unit pricing affect household waste generation/disposal behavior or the cost of managing solid waste? Do other features of unit pricing/other programs promote or mitigate the effects of unit pricing? Employs case study of 17 communities with detailed data from Perkaskie, PA, Ilion, NY, and Seattle, WA. Findings: Unit pricing programs have both positive and negative effects that are interrelated with other system features. Effects observed in this study include: significant waste stream reductions; unit pricing programs and recycling programs are complementary–both are more effective together than separately; household response to higher prices may be reduced when recycling facilities are less easily accessible or there is a large proportion of multifamily housing; implementation of unit pricing did not contribute to increased littering and/or sewerage; households in smaller communities evidenced more significant changes in waste generation; added costs of unit pricing and recycling programs were offset by savings from waste reduction and reduced service frequency; unit pricing was well received by the public.	
Goldberg, Dan	1990	"The Magic of Volume Reduction" *Waste Age*	19 98-104	Q: Will volume-based waste management costs increase illegal dumping or increase recycling rates? Case study assessment of aggregate data from communities in New Jersey, Minnesota, Pennsylvania, Washington and Canada. Findings: Generally, while the volume-based approach is not trouble-free, most communities report favorable results in reducing the waste stream and increased recycling.	3
Strathman, James G.; Anthony M. Rufolo; and Gerard C. S. Mildner	1995	"The Demand for Solid Waste Disposal" *Land Economics*	71 57-64	Q: What are the effects of pricing on landfill disposal? Analysis of monthly data from Portland, OR in an empirical model in which tons of landfilled space/1,000 residents is specified as a function of tipping fees, average weekly income, and construction employment. Findings: Increased tipping fees lead to significant declines in landfilled waste/per capita. Estimated tip fee elasticity is larger than elasticities estimated in earlier studies, suggesting greater responsiveness to pricing than previously thought. In the absence of variable cost pricing, there is evidence of large efficiency losses. Communities should have more successful recycling programs when prices for collection and landfilling are greater than zero. More data are needed to evaluate illegal disposal activities and costs of disposal alternatives.	1
4.06 Factors That Affect The Perceived Financial Feasibility					
Bacot, Hunter; Terry Bowen; and Michael R. Fitzgerald	1994	"Managing the Solid Waste Crisis: Exploring the Link Between Citizen Attitudes, Policy Incentives, and Siting Landfills" *Policy Studies Journal*	22 229-244	Q: What policy options mitigate citizen opposition to landfill siting? Employs a causal model to evaluate the potential of operation and economic incentives for tempering citizen opposition to all solid waste options. Findings: Local committee oversight, property tax credits, school funding have the greatest potential for promoting citizen acceptance of siting a landfill in their community.	1
Bogert, Susan and Jeffrey Morris	1993	"The Economics of Recycling" *Resource Recycling*	(Sept.) 76-80	Q: Does recycling cost more than disposal? Summary of prior case study of four Washington state cities that are geographically diverse, use different collection/materials marketing/disposal methods, and differ in population. Documents 1992 costs of curbside recycling versus disposal and compares costs/prices for use of five recycled materials against common virgin material substitutes. Findings: Disposal costs exceeded recycling costs in all four cities; where disposal systems are expensive, recycling programs are also expensive; mandatory garbage collection fees fund all curbside or disposal costs; households that recycle may save by reduced frequency or volume of garbage collection. Suggests recycling makes economic sense when compared to disposal.	3
Carroll, Wayne	1995	"The Organization and Efficiency of Residential Recycling Services"	21	Q: Do recycling costs differ between municipal, private-contract, and market-based operations? Uses 1992 grant application data from 57 Wisconsin cities with curbside recycling programs to regress mean net household recycling costs on several sets of independent variables. Findings suggest that residential	1

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		Eastern Economic Journal	215-225	recycling costs have some similarities with garbage collection costs. Recyclable collection is subject to economies of density but not economies of scale. Costs are lowest in cities contracting with single haulers.	
4.06 Factors That Affect The Perceived Financial Feasibility (Cont.)					
Dinan, Terry M.	1993	"Economic Efficiency Effects of Alternative Policies for Reducing Waste Disposal" *Journal of Environmental Economics and Management*	25 242-256	Q: Are combined disposal tax/reuse subsidies more efficient policies to reduce the waste stream than virgin material taxes? Examines the production of two goods and determines the "optimal" levels of production, selections of inputs, and number of firms in industry that would result if disposal costs were internalized. Findings: Virgin materials taxes cannot lead to optimal resource allocation while combined disposal tax and reuse subsidies can. Suggests that this "combination" policy is theoretically consistent with unit-based pricing initiatives, but may in some situations have advantages.	1
Folz, David H.	1995	"The Economics of Municipal Recycling: A Preliminary Analysis" *Public Administration Quarterly*	19 299-320	Q: What are the key cost/benefit factors of city recycling programs? Based on actual cost/benefit data, what are the most fiscally efficient forms of recycling programs? Cost/benefit analysis based on 1989 survey responses of 450 municipal recycling coordinators in 25 states. Representative nature of the distribution of responses enables generalization to the nation. Comparisons are made between jurisdictions with similar programs among two program types: curbside collection of materials and drop-off/buy-back operations. Findings: There is considerable variation among recycling program funding sources; however, the city general fund is the most important source of program revenues. Revenue from refuse-derived sources (sale of materials, fees or charges for collection/disposal of waste) accounted for about 35% of municipal recycling operation funding. Key program costs depend on the program type, size, and scope. Average total costs of curbside programs was $171,272; mean total cost of drop-off only programs was $23,317. City curbside recycling programs recovered revenues averaging 83.3% of mean operating and capital costs per ton. Drop-off programs recovered 78.5% of their costs. Mandatory curbside recycling pickup was found to be the most cost-effective option, but there are strong economic incentives to implement either voluntary curbside or drop-off programs "when these options are compared to the costs incurred for the traditional methods of waste disposal." Cities with lower unit recycling costs reflect higher popular participation and adopted several policies to encourage more participation. In general, recycling is found to be the preferred financial alternative for solid waste management "(compared to landfilling or incineration) if material revenue is cut by half and the estimated savings in disposal costs are reduced by half".	3
Highfill, Jannett; Michael McAsey; and Robert Weinstein	1994	"Optimality of Recycling and the Location of a Recycling Center" *Journal of Regional Science*	34 583-597	Q: What conditions indicate a city should implement a recycling program? Employs a static model to "determine the relationship between the amount of recycling and the location of a recycling center," and to identify conditions by which recycling will reduce SWM costs enough to make recycling optimal. Findings: Cost savings solely from transportation costs may economically justify community recycling programs; with increased recycling, optimal facility location shifts from landfills to centrally located sites in the city; factors optimizing recycling programs include sorting costs/unit of waste, transportation costs/unit of waste, and city size; restrictions limiting siting of the recycling facility can reduce optimality (that is, recycling centers located near landfills increase the likelihood of optimal city recycling versus recycling facilities that must be sited on the opposite side of the community from the landfill.)	1
Keeler, Andrew G. and Mitch Renkow	1994	"Haul Trash or Haul Ash: Energy Recovery as a Component of Local Solid Waste Management" *Journal of Environmental Economics and Management*	27 205-217	Q: How do economic variables function to affect local choice over disposal strategies? Developed a model of municipal choice of MSW disposal technologies to examine incineration, landfilling and recycling options. Findings show that desirability of incineration and optimal size of an energy recovery facility depend on costs of the various options and characteristics of the waste stream, and that "under most conditions allocating resources to incineration reduces the incentives to recycle."	

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
4.06 Factors That Affect The Perceived Financial Feasibility (Cont.)					
Ludwig, Kathy and Tom Jones	1992	"The Advance Disposal Fee: Has Its Time Come?" *Resource Recycling*	(Sept.) 94-101	Q: What are the pros/cons of advanced disposal fees (ADFs)? Discusses two key issues regarding ADFs, trends in implementation. Suggested benefits of ADFs are as a funding source to support waste reduction/recycling, and incentive for source reduction. As no true ADF has yet been implemented, there is no conclusive proof of effects. Key questions for policymakers are: At what point in distribution chain should ADF be levied; how are revenues to be used? Profiles "pseudo" ADF used in 12 states. Suggests that increased use of ADFs indicates appeal to policymakers, but, while prior experience is promising, true effectiveness is unclear.	3
Mainwaring, Lynn	1995	"Primary Resource Use and Voluntary Recycling Schemes: Dynamic Issues in Global Context" *Resource and Energy Economics*	17 341-356	Q: What is the impact of voluntary recycling programs on the use of primary or virgin materials? Developed a dynamic model to test the hypothesis that voluntary programs may in the long run do more harm than good to the environment. This global growth model distinguishes between primary material use and primary material production. Dynamics are modeled in a discrete-time framework. Findings: Recycling may be no more than a short-run solution. In the long run we must address the question of environmental sustainability of high-output growth. Producers of final goods are effectively subsidized by voluntary recycling efforts, and their "accumulation intensity" rises to a point that may offset unit savings of primary/virgin materials.	1
Nestor, Deborah Vaughn	1991	"Increasing the Rate of Recycling When Demand is Price-Inelastic: A Case Study of the Market for Old Newspapers" *Dissertation, The University of Tennessee, Knoxville, TN*		Q: Have policies intended to encourage recycling not been effective due to the price inelasticity of the old newspapers (ONP) input demand schedule? Developed and tested model of the demand for ONP as "an input in newsprint production." Findings: ONP recycling is more dependent on influences of the final output market than on relative input prices. Suggests that expanded output requires added new newsprint capacity investment, and that this investment has been "biased toward ONP-based mills."	1
Nestor, Deborah Vaughn	1992	"Partial Static Equilibrium Model of Newsprint Recycling" *Applied Economics*	24 411-417	Q: Do policies to increase supply of old newspapers (ONP) stimulate the rate of recycling? Do "fiscal biases" favoring raw materials hinder newsprint recycling? Employs a static equilibrium model to test hypotheses regarding ONP recycling. Findings suggest policies to lower ONP prices/increase ONP supplies are ineffective stimulants for recycling; policies favoring timber industry growth have not hindered ONP recycling; growth in output is the key incentive for ONP use in the newsprint industry.	1
Ready, Mark J. and Richard C. Ready	1995	"Optimal Pricing of Depletable, Replaceable Resources: The Case of Landfill Tipping Fees" *Journal of Environmental Economics and Management*	28 307-323	Q: How can optimal tipping fees for a regional landfill best be determined? Uses a general model for pricing a depletable, replaceable asset, and illustrated its use in determining optimal tipping fees. Findings: Optimal fees include an element that grows at the real interest rate as landfill space is depleted, and drops when a new landfill is built. "Because the scarcity cost of landfill space increases as the landfill is filled, it may be optimal to delay a waste reduction program (such as recycling, composting, or incineration) until the landfill is partially full."	1
The Economist	1991	"Recycling: How to Throw Things Away" *The Economist*	319 17-22	Q: With the prospect of ambitious industry recycling targets, will the benefits of recycling outweigh the economic costs of reusing recycled materials? Presents rhetorical arguments for/against recycling policies, aggregate recycling data regarding trends in Europe, Japan and U.S. Findings: Governments should be more logical in their policy approaches to encouraging recycling. Economic pressures, issuing/auctioning permits for materials to be landfilled, and reducing packaging should also be considered in the policy arsenal.	3
Wiseman, A. Clark	1991			General discussion of impediments to least-cost solid waste management including a lack of cost data and analysis; failure to correctly price waste collection/disposal; and political obstacles. Suggests need for research and public information programs to identify and communicate the true social costs of various management scenarios.	3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
		"Impediments to Economically Efficient Solid Waste Management" *Resources*	105 9-11		

4.06 Factors That Affect The Perceived Financial Feasibility (Cont.)					
Wiseman, Clark	1992	"Government and Recycling: Are We Promoting Waste?" *Cato Journal*	122	Q: Have factual misreadings and misrepresentations distorted local government decision making promoting governmental programs and incentives? Uses rhetorical argument and aggregate data to make the case that recycling has been pushed past economically efficient levels due to landfill siting problems and misperceptions of the environmental impact of landfills, overestimates of recycling benefits, and underestimates of recycling costs. Suggests that efficient, rational management of MSW should incorporate adequate environmental standards for landfills; pricing of solid waste disposal services on a per-unit basis equal to full disposal costs; and the political difficulty of siting landfills should be averted by reducing the power of local elected officials to grant/deny landfill permits.	3
4.07 Recyclables Trading/Futures Markets					
Shulman, Seth	1996	"Curbside Commodities" *Technology Review*	99 14-15	Descriptive editorial presenting aggregate data justifying addition of recycled plastic, paper and glass to futures trading on the floor of the Chicago Board of Trade. Suggests that commodities exchange attention will help bring competition, standardization to the recycled materials market.	2
Watson, Tom	1991	"Cooperative Marketing: A Delicate Balance" *Resource Recycling*	(Feb) 26-31	Q: How can local governments set up successful cooperative marketing programs? Uses case studies of New Hampshire, Vermont, New York and Tennessee programs to assess benefits, pitfalls of marketing cooperatives. Findings suggest considerable promise for cooperative marketing, but care must be taken not to aggravate the private sector.	2

5.0 DECISION-MAKING PROCESSES

Author (s)	Date	Title / Publication Name	Vol./Edition / Pages	Description/ Findings	Use
5.01 Program Design Process/Changes/Evolution					
Allen, Phillip C.; Peter Foye; and Thomas M. Henderson	1990	"Recycling and Incineration: Not Mutually Exclusive in Broward County, Florida" *Government Finance Review*	6 7-12	Q: How can SWM planning and financing incorporate responses to changes in technology, environmental and tax laws, service demands, public perceptions and attitudes? Case study of Broward County, FL. Findings suggest importance of developing integrated SWM plans, developing/maintaining adequate program information, expanding recycling/education efforts, and developing flexible financing plans to meet changing needs.	3
Anderson, Deborah D. and Laurie Burnham	1992	"Toward Sustainable Waste Management" *Issues in Science and Technology*	(Fall) 65-72	Q: Can our industrial society change how it handles its end products and make more efficient use of materials, use better disposal methods, and enhance its environmental sensitivity? General review and assessment of options, barriers, market incentives, government strategies, and consumer participation issues. Findings suggest that new technologies have made comprehensive solid waste management strategies viable, and that there is unprecedented interest by industry, government and consumers in environmental issues. Suggests that, by avoiding simplistic legislated solutions and permitting market forces to function, U.S. can succeed.	2
Bacot, Hunter; Amy S. McCabe; Michael R. Fitgerald; Terry Bowen; and David H. Folz	1993	"Practicing the Politics of Inclusion: Citizen Surveys and the Design of Solid Waste Recycling Programs" *American Review of Public Administration*	23 29-41	Q: Are citizen background characteristics and citizen environmental attitudes associated with preferred recycling policy options? Opinion poll data are used for bivariate tests of hypothesized associations. Findings suggest that hypothesized associations vary according to citizen involvement needed to sustain a particular program. While race was the only background characteristic consistently associated with various recycling preferences, several environmental attitude indicators were significant. Suggests need for being aware of/sensitive to local opinions, and using this information for program decision making to improve participation.	3
Everett, Jess W. and Abhijit R. Modak	1993	"Optimal Scheduling of Composting, Recycling, and Landfill Operations in an Integrated Solid Waste Management System" *Journal of Resource Management and Technology*	21 122-131	Q: Can deterministic linear programming assist decision makers in long term planning for an integrated SWM system? Developed a mathematical model to schedule landfill operations and diversion options and employed case study to illustrate model viability in identifying optimal long term cost solutions given a variety of disposal options. Results suggest it may be practical to implement more expensive options than landfills to defer future, more expensive landfills.	1
Fletcher, Jeff	1992	"Why Unit Pricing Makes Sense for Solid Waste" *Nation's Cities Weekly*	(Oct. 19) 10	Q: What is unit pricing, what are its advantages? Discusses alternative fee structures in common use, presents arguments for use of unit pricing. Suggested advantages of unit-pricing: 1) equitable method for increasing recycling and composting, sending pricing signals to consumers, reducing landfill tip fee costs; 2) providing realistic picture of waste collection and disposal costs to consumers while permitting some control over household costs; 3) relies on market forces and does not favor one waste reduction method over others; and 4) rewards waste source reduction.	2
Florini, Karen L., Richard A. Denison, and John Ruston	1990	"An Environmental Perspective on Solid Waste Management" *Integrated Solid Waste Management: Options for Legislative Action, Frank Krieth (ed.)*; Schenctady, NY: Genuim Publishing Co.	173-196	Q: What are the major issues confronting SWM? Presents an examination of the issues of removing economic barriers for recycling and creating markets for recycled goods; the need for a broad approach when assessing risks of incineration as an element of waste management; and proposed revisions, potential pitfalls to federal landfilling criteria.	3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
5.01 Program Design Process/Changes/Evolution (Cont.)					
Folz, David H.	1991	"Recycling Program Design, Management, and Participation: A National Survey of Municipal Experience" *Public Administration Review*	51 222-231	Q: How can municipalities maximize and sustain citizen participation in solid waste recycling programs? Analyzes data from a national survey of municipal recycling coordinators. Findings: "Democratizing" program planning and design processes, and mandatory recycling participation significantly influence citizen participation. Combining voluntary participation with other strategies, such as curbside delivery, use of private contractors, or free bins, also worked well.	3
Folz, David H. and Joseph M. Hazlett	1991	"Public Participation and Recycling Performance: Explaining Program Success" *Public Administration Review*	51 526-532	Q: "What determines the success of different local recycling programs?" Using national recycling program survey data, authors used bivariate analysis and OLS regression to assess independent influences on recycling participation and diversion. Findings: Program success depends more on the policies chosen, how they are selected, and how they are implemented rather than on local community characteristics.	3
Frosch, Robert A.	1995	"The Industrial Ecology of the 21st Century" *Scientific American*	(Sept.) 178-181	Q: What factors may contribute to a clean and efficient industrial economy? Discussion of environmental concerns, ability of industry to mimic natural world's ability to recycle, minimize waste. Suggests need for industry to solve waste problems internally; the industrial sector should act to minimize overall waste production with design/production of reusable products and the information available on who has/needs/uses what materials; a regulatory framework that limits barriers to reuse by allowing the flow of used materials between consumers and manufacturers, one firm and the next, and one industry an another.	3
Grogan, Terry	1990	"The Environmental Protection Agency's Municipal Solid Waste Program: Current Action and Future Plans" *Integrated Solid Waste Management: Options for Legislative Action,* Frank Krieth (ed.), Schenctady, NY: Genuim Publishing Co.	155-172	Q: What are EPA's current projects to address the MSW crisis? What agency activities are planned for the near future? Descriptive report of the EPA's efforts to address the MSW problems identified by the Municipal Solid Waste Taskforce, and the agency's goals and objectives for resolving the crisis. Includes an edited version of author's question and answer session with state legislators.	3
Guerra, Sarith	1992	"Markets for Recyclables: The Challenge for Local Government Recycling Programs" *Municipal Yearbook*	59 16-26	Extensive description of recycling and recycling issues. Topics include: 1) description of the recycling process; 2) role of local government in the marketplace; 3) recycling terminology; 4) barriers to marketing; 5) supply and demand; 6) competing in today's marketplace; 7) contracting arrangements; 8) cooperative marketing; 9) developing local markets; 10) closing the loop; 11) action steps for local governments; and 12) local government procurement.	3
Kreith, Frank (ed.)	1990	"Integrated Solid Waste Management: Options for Legislative Action" *Schenectady, NY: Genvim Publishing Corporation*		Collection of articles based on presentations at the 1989 NCSL solid waste forum. Common theme is the need for integrated waste management systems that fit local conditions. Each chapter examines a step in dealing with disposal of waste generated.	3
5.01 Program Design Process/Changes/Evolution (Cont.)					
	1991				3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
Lodge, George C. and Jeffrey F. Rayport		"Knee-deep and Rising: America's Recycling Crisis" *Harvard Business Review*	(Sept/Oct) 128-138	Q: Can American governments and businesses move beyond adversarial relationship to a constructive, problem-solving relationship? Uses case studies, aggregate data regarding plastics recycling to suggest that current practices have resulted in everyone (government, business, the public, and the environment) losing, and the problem getting worse. Findings suggest the need for comprehensive, systemic solid waste disposal infrastructure to make an integrated approach workable. For the approach to work, system must include five key values: 1) Government and industry must work as partners; 2) Policy initiatives must balance the supply and demand in the recycling system; 3) Recycling infrastructure must operate at national or regional scale to capture real economies; 4) Local, state and federal governments must act in partnership to coordinate processing and sale; and 5) MSW disposal systems must integrate decisions regarding recycling, incineration and landfilling, address issues of scale, balance supply and demand, and involve all necessary participants in the process.	
Pieters, Rik G. M.	1991	"Changing Garbage Disposal Patterns of Consumers: Motivation, Ability, and Performance" *Journal of Public Policy & Marketing*	10 59-76	Q: How do environmental issues shape human behavior? Assesses consumer waste disposal in environmental-friendly ways, and develops a three-step approach to understanding consumer recycling participation. Analyzes the consumer's effort to change material streams, and evaluates determinants of these decisions. Results suggest that these three steps serve as a general approach to assessing consumer behavior in environmental protection programs.	1
Spang, Aletha	1990	"Recycling in Review: Year Two for New Jersey" *Government Finance Review*	6 11-14	Q: Can mandatory recycling succeed? Review of statewide survey results taken two years after program implementation. Program was adopted in response to crisis situation that forced closure of more than 80% of state landfills, and higher tipping fees. Program requires all communities to recycle leaves and at least three of paper, metals, glass, plastics, and food wastes. Financial incentives were used to encourage recycling of auto scrap, asphalt, oil, demolition waste. Early data and survey results suggest significant increases in public participation, public awareness, waste diversion.	3
Stavins, Robert N.	1993	"Market Forces Can Help Lower Waste Volumes" *Forum for Applied Research and Public Policy*	8 6-15	General summary of concerns that should be addressed by decision makers faced with the need to establish waste-management policies.	2
Watson, Tom	1990	"Municipal Programs Booming in the 10 Biggest Cities" *Resource Recycling*	(Dec.) 27-36	Q: How have the nation's most populous cities responded to public, political, and state mandated pressures to recycle? Presents descriptive data on 10 municipal recycling programs based on survey of recycling officials. Includes details of community population, square miles, current recycling effort, planned recycling efforts, recycling budget, number of administrative staff, and the key recycling personnel. Suggests that growth in curbside programs is "proof" of the political necessity of recycling but that the rapid growth resulting from this political pressure can contribute to program chaos.	3
West, Jonathan P.; Richard C. Feiock; and Stephanie J. Lee	1992	"Municipal Solid Waste Management and Recycling: Strategies and Issues" *Municipal Yearbook*	59 27-35	Q: What are the strategies being employed, issues being faced by municipal officials? Analysis of responses by public works directors in U.S. cities of 5,000+ population. Among findings: Results confirmed general acceptance of EPA waste management hierarchy; the majority of programs appeal to citizens' environmental conscience to encourage recycling participation rather than other forms of incentives; major concerns include the cost/construction of landfills and waste-to-energy plants, and hazardous waste collection, disposal, and enforcement.	3
5.01 Program Design Process/Changes/Evolution (Cont.)					
Wiseman, Clark					3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
	1992	"Government and Recycling: Are We Promoting Waste?" *Cato Journal*	12 443-461	Q: Is the MSW issue an ecological/economic problem or is it a political issue manifested through "flawed" government decision making? Rhetorical argument/discussion of perceptions/views of MSW options, economic costs/benefits, and non-economic rationale for recycling. Suggests that landfilling, while environmentally sound and cost-effective, presents political difficulties that encourage costly recycling efforts. Suggests that recycling policies have been overextended past economically efficient levels due to siting problems and public misperceptions of the negative impacts of landfilling. Suggests the need for three basic policies: 1) Maintain adequate environmental standards for landfills; 2) Adopt unit pricing at rates equal to disposal costs to place the cost/benefit assessment on the household; and 3) Reduce local officials' power to grant/deny landfill permits.	
Young, John E.	1991	"Tossing the Throwaway Habit" *World Watch*	4 26-33	Q: How can we confront inefficient use of raw materials and energy? Presents rhetorical argument, aggregate data to suggest inadequacy of current policies to contend with the garbage crisis. Suggests preventing waste with more efficient use of resources can reduce the garbage problem and reduce environmental damage.	2
5.02 Management/Administration Mechanisms					
Jones, Teresa B.; Edward J. Calabrese; Charles E. Gilbert; and Alvin E. Winder	1990	"Solid Waste Education Recycling Directory" *Boca Raton, FL: Lewis Publishers*	1109	Summary of waste management curricula for each state by categories and features specific to each program. Includes curriculum description and goals, project history, legislative initiative and funding sources, educational requirements/infrastructure.	3
5.03 Intergovernmental Dimension . . . State/National Policies and/or Standards					
Beck, Patty and Pete Grogan	1991	"Minimum Content Legislation: An Effective Marketing Tool" *Resource Recycling*	(Sept.) 90-99	Q: Does minimum content legislation stimulate markets for recyclable materials? Describes the conditions leading up to the negative market for old newspapers in 1990 and details the types of minimum content legislation enacted in states to stimulate this market. Findings: Voluntary or mandatory minimum content legislation can be a means to close the recycling loop. More effective requirements include mandatory use of post-consumer materials. Suggests the need to standardize requirements across states; that states will likely rely on minimum content legislation to expand market capacity for other commodities.	3
Boerner, Christopher and Kenneth Chilton	1994	"Recycling: What a waste?" *The American Enterprise*	5 14-18	Q: Should U.S. policymakers consider proposals to increase demand for recycled materials? Presents rhetorical argument, aggregate data, and case study of Germany's green dot program. Findings: Efforts to fix the demand side of the recyclable market are far from inexpensive, causing consumers to pay the costs rather than taxpayers. Suggests such measures also reduce packaging innovations and distort market efficiency without benefiting the environment.	3
Cairncross, Frances	1992	"How Europe's Companies Reposition to Recycle" *Harvard Business Review*	(Mar/Apr) 34-45	Q: How has recycling policy evolved in the European Community? Describes the uncoordinated efforts of the EC to limit packaging waste. Discusses German, Dutch, and French initiatives and approaches. Suggests that, while the EC wants a coherent, unified policy, such a directive is unlikely in the near future. Industry response to these pressures has been to innovate and cooperate, refocus on environmental effects of their products. Suggests that governments must be clear about priorities/goals, and should avoid exclusive focus on recycling. Recommends one goal for industry: minimize waste. Industry should then take responsibility for most efficiently meeting that target.	3
Glenn, Jim and David Riggle	1991	"The State of Garbage in America" *BioCycle*	(May) 30-35	Q: What were the key solid waste initiatives passed by state legislatures in 1990? Presents aggregate data, discussion of BioCycle's nationwide survey of state laws. Findings: State legislation was less plentiful than in 1988-89, and is characterized as adjustments, revisions, additions to existing statutes. The 1990 record illustrates great versatility, with bans on specific materials, mandated waste reduction goals, market development, advance disposal fees.	3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
5.03 Intergovernmental Dimension . . . State/National Policies and/or Standards (Cont.)					
Khator, Renu	1993	"Recycling: A Policy Dilemma for American States" *Policy Studies Journal*	21 210-226	Q: What factors contribute to a state's inclination to recycle? Employs separate statistical methods to test four conceptual models: 1) political model; 2) economic model; 3) policy-perpetuation model; and 4) physical factor model. Findings: Economic variables have little explanatory power; the political model yields mixed results. Both the policy-perpetuation and physical factor models reveal significant relationships. Overall, results suggest the importance of physical composition (population density, region), and policy image (environmental bureaucratic strength, innovativeness, and commitment) as significant predictors of a state's recycling effort.	1
Kundell, James E.	1990	"Municipal Solid Waste Management in Georgia: Policy Alternatives" *Carl Vinson Institute of Government, The University of Georgia*		Discussion of integrated waste management and the policy alternatives available to Georgia decision makers seeking to effectively manage municipal solid waste. Emphasis is on the lack of adequate funding to compete with other state priorities.	3
Kundell, James E. and Deanna L. Ruffer	1993	"10 Commandments for Solid Waste" *Forum for Applied Research and Public Policy*	8 16-21	General discussion of suggestions to "guide" state legislators developing statewide solid waste management laws and regulations.	2
McCabe, John	1993	"What Happens When Businesses Must Take Part in Recycling?" *Resource Recycling*	(Mar.) 73-80	Q: Does mandatory participation of business and institutions in recycling programs work? Case study of Rhode Island experience with mandated commercial recycling participation. Discusses program details/results, presents aggregate data regarding percent of waste recovered, composition of collected materials, economic effect of recycling, annual implementation costs. Findings: State businesses are recycling 34% of their waste; 58% of businesses indicate savings from recycling; implementation costs rarely exceeded $5,000.	3
Powell, Jerry	1992	"Federal Disincentives to Recycling" *Resource Recycling*	(June) 44-45	Q: What is the effect of federal subsidies for virgin material use? Summarizes conclusions of preliminary assessment prepared for EPA. Suggests that the broad area of energy subsidies can be considered a significant economic barrier to recycling, but that several federal policies and programs that benefit virgin resource industries do not act as significant barriers.	3
Pytte, Alyson	1990	"Congress May Have to Intervene as Garbage Wars Intensify" *Congressional Quarterly*	48 173-177	Discussion of pending RCRA reauthorization, state and local demands for Congressional action. Also presents a history of EPA regulatory action and events contributing to the "landfill crisis."	3
Relis, Paul	1992	"Recycling: An Answer Waiting for a Solution" *Forum for Applied Research and Public Policy*	7 52-55	Summary of the problems/challenges following the national shift to recycling. Suggests current approaches may endanger the industry's future; have overlooked the industrial changes a shift to recycling requires; may undermine financing for domestic recycling while subsidizing foreign markets with inexpensive raw materials. Suggests federal government needs to assess supply/demand for recycled commodities, share information with state and local governments, and coordinate legislation to enhance demand for secondary materials.	2
5.03 Intergovernmental Dimension . . . State/National Policies and/or Standards (Cont.)					
Stolzenberg, John			197-211		3

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
	1990	"State Solid Waste Legislation" *Integrated Solid Waste Management: Options for Legislative Action, Frank Krieth (ed.)*; Schenctady, NY: Genuim Publishing Co.		Q: What are the current and future initiatives in state legislatures to address solid waste management issues? Presents details of current legislative activities in the states and Puerto Rico, and summary of key areas being, and expected to be addressed.	
Wiseman, A. Clark.	1990	"U.S. Wastepaper Recycling Policies: Issues and Effects" *Resources for the Future Discussion Paper ENR 90-14,* Washington, DC	(Aug.) 66 pgs.	Q: What are the potential effects of increased waste paper recovery on markets, production technologies, material utilization rates? Summarizes economic issues, the record of federal, state and local policy responses. Presents preliminary estimates of potential effects of increased wastepaper recovery. Findings: Recovery/recycling policies are being implemented without regard to economic and social costs of various alternatives. Studies promoting recycling benefits tend to ignore the high cost of human time. When taken into account, this cost weighs against recycling as a waste disposal option, suggesting that high levels of recycling will be wasteful of social resources. Volume-based pricing provide a rational incentive for voluntary household recycling. Increased recycling will reduce demand for virgin wood fiber; however, with increased recycling, it is likely that land now used for silviculture will be put to other uses, contributing to smaller forest inventories.	3
5.04 Operational Problems, Challenges					
Butterfield, David W. and Atif A. Kubursi	1993	"Regional Economic Effects of Recycling in Ontario" *Canadian Journal of Regional Science*	16 413-431	Q: What are the regional economic effects of increased recycling? Employs a regional input-output model to estimate economic effects of various economic policies in Ontario, and calculate economic effects for six scenarios. Findings suggest that larger employment losses are related to losses in export markets due to foreign demand for recycled content in paper/paper products. Regional employment gains are related to increased recyclable waste collection industries and shifts in location of employment in the paper/paper products industry.	1
Khator, Renu and John Huffman	1993	"A Survey of Recycling Coordinators" *Biocycle*	(Oct.) 37	Q: What do recycling coordinators see as effective recycling strategies, barriers to program implementation, economic issues? Survey of 1000 local recycling coordinators. Findings: The strongest impetus for recycling programs was pressure from the state; community drop-off centers and curbside pick up are the most common recycling programs; buy-back centers and tax incentives are viewed as the least effective recycling strategies; and absence of recycled product markets, cost-effectiveness, and a lack of funding are the key barriers to recycling programs. The most important factor in improving program performance is seen as finding markets for recyclable materials in their own states.	3
5.05 Online Data Bases/Information Sources/Software to Help Recycling Program Design/Decision Makers					
Powell, Jerry	1992	"A Directory of MRF Vendors and Equipment Suppliers" *Resource Recycling*	(Mar.) 52-61	Directory of materials recovery facility service and equipment suppliers.	2
Resource Recycling	1994	"Recycling and Composting Equipment Directory" *Resource Recycling*	(Aug.) 63-102	Directory of recycling and composting manufacturers and distributors.	2
Resource Recycling	1992	"Recycling Equipment Directory" *Resource Recycling*	(Aug.) 97-146	Recycling Equipment Company Directory.	2

Author (s)	Date	Title Publication Name	Vol./Edition Pages	Description/ Findings	Use
5.05 Online Data Bases/Information Sources/Software to Help Recycling Program Design/Decision Makers (Cont.)					
Resource Recycling	1991	"Resource Recycling Equipment Company Directory" *Resource Recycling*	(Aug.) 47-103	Directory listing approximately 400 companies manufacturing and/or distributing recycling equipment.	2

SUPPLEMENTAL READINGS ORGANIZED BY DATE, AUTHORS

		Title	Vol./Edition	Description/	
Author (s)	**Date**	**Publication Name**	**Pages**	**Findings**	**Use**
Gray, Ralph	1972	"The Economics of Disposal Pollution and Recycling" *Quarterly Review of Economics and Business*	12 43-51	Q: How can recycling be organized in a throwaway society? Rhetorical argument raising questions and suggesting answers associated directly and indirectly with container, newspaper, and automobile disposal. Models resource allocation effects, disposal/avoidance alternatives, consumer costs/benefits to suggest that recyclable sorting should be done in the home, and that "reverse flow" in marketing/distribution channels can produce recycling without added incentives.	1
Reid, Dennis H.; Paul D. Luben; Robert J. Rawers; and Jon S. Bailey	1976	"Newspaper Recycling Behavior: The Effects of Prompting and Proximity of Containers" *Environment and Behavior*	8 471-482	Q: Do prompts and proximity affect newspaper recycling behavior? Case study of one community using pre- and post-test measures and interviews. Findings: Informing people of recycling locations and closer proximity increases recycling behavior.	1
Dunlap, Riley E. and Kent D. Van Liere	1978	"The New Environmental Paradigm" *Journal of Environmental Education*	9 10-19	Q: Has the public come to accept the ideas embodied in the "New Environmental Paradigm?" Survey findings: Both environmentalists and the general public accept the NEP. Findings also support authors' construct of an "NEP Scale."	1
Luyben, Paul D. and Jon S. Bailey	1979	"Newspaper Recycling: The Effects of Rewards and Proximity of Containers" *Environment and Behavior*	11 539-557	Q: Do convenient containers and/or rewards contribute to increased newspaper recycling? Findings: Both conditions increase newspaper recycling, but rewards are most effective. Recyclers should consider procedures and target population.	3
Schnelle, John F.; M. Patrick McNees; Murphy M. Thomas; John G. Gendrich; and Gwen P. Beagle	1980	"Prompting Behavior Change in the Community: Use of Mass Media Techniques" *Environment and Behavior*	12 157-166	Q. Do antilittering newspaper campaigns contribute to reduced littering? Uses a multiple baseline, time series design to assess effects of media campaign. Findings suggest relationship between newspaper intervention and reduced levels of litter.	1
Larson, Mark A. and Karen L. Massetti-Miller	1984	"Measuring Change After a Public Education Campaign" *Public Relations Review*	10 23-32	Q. Do public education campaigns increase community recycling? Compare pre- and post-campaign survey data. Found little change in overall attitudes or in levels of recycling behavior.	1
Curlee, T. Randall	1986	"The Economic Feasibility of Recycling: A Case Study of Plastic Waste" *Greenwood Press*		Identifies, assesses the economic and institutional incentives and barriers to recycling/disposing of plastic wastes. Finds that while plastic recycling is expected to increase, basic economic, institutional and technical constraints will limit increases.	1
DeYoung, Raymond	1986	"Some Psychological Aspects of Recycling"	18		1

		Environment and Behavior	435-449	Q: What satisfactions do people derive from recycling? Uses mail survey of 107 households. Findings reveal that people derive separate and distinct satisfactions from material recycling and reuse, but need further inquiry as to why people bother to conserve.	
DeYoung, Raymond and Stephen Kaplan	1986	"Conservation Behavior and the Structure of Satisfactions" *Journal of Environmental Systems*	15 233-242	Q: What factors influence energy-conserving behavior? Interviewed 30 "conservers" to identify factors associated with daily energy conservation activities. Found eleven distinct types of satisfaction, only one being economic in nature.	3
Geller, E. Scott and Galen R. Lehman	1986	"Motivating Desirable Waste Management Behavior: Applications of Behavior Analysis" *Journal of Resource Management and Technology*	15 58-68	Argues for the antecedent-behavior-consequence approach in waste management programs, and describes how applied behavior analysis may be relevant to organizing/implementing programs to encourage waste reduction, litter control, and resource recovery.	1
Schwab, Jim	1986	"Garbage In, Garbage Out" *Planning*	52 4-9	General discussion of landfill controversy in several midwestern states and the problems/opportunities presented by other alternatives (incineration, transfer, recycling). Suggests need for building consensus behind the most logical alternative(s).	3
Arcury, Thomas A. and Timothy P. Johnson	1987	"Public Environmental Knowledge: A Statewide Survey" *Journal of Environmental Education*	17 31-37	Q: What is the general level of public environmental knowledge? Survey findings: Public environmental knowledge remains low, major correlates are education, income and sex.	1
Goldoftas, Barbara	1987	"Recycling: Coming of Age" *Technology Review*	90 28-35	Overview of the evolution and comparative state of recycling worldwide.	2
Katzev, Richard D. and Anton U. Pardini	1987	"The Comparative Effectiveness of Reward and Commitment Approaches in Motivating Community Recycling" *Journal of Environmental Systems*	17 93-113	Q: Do cost effective recycling programs require some form of incentive to encourage participation? Directly compared the relative impact of commitment and incentive techniques in promoting recycling among 59 middle to upper-middle class households in Portland, OR. "Commitment" households made a formal, signed pledge to recycle newspapers over a five-week period. "Incentive" households received tokens good for purchases at local merchants each time they recycled their newspapers. The study also included a combine "commitment and incentive" group of households and an untreated control group. Findings: No single treatment technique was uniformly more effective than any other. Among households recycling at least one, the commitment condition, was the most effective. The combined commitment and incentive was more effective on some recycling measures, and the commitment only condition was on others; neither group was clearly superior to the other. In general, results suggest no evidence to support the notion that incentives are required to promote recycling. In both conditions using a commitment manipulation, the overall occurrence of recycling was more than with the incentive condition. This suggests that it may be more effective to have individuals commit to a behavior rather than reward them for doing so.	1
Marshall, Eliot L.	1987	"America's Big Mess: After You Take Out the Trash, Where Will They Put It?" *Governing*	1	Review of events leading up to Philadelphia's trash crisis and later decision factors, problems in their choice of "waste-to-energy" options.	3

Mohai, Paul and Ben W. Twight	1987	"Age and Environmentalism: An Elaboration of the Buttel Model Using National Survey Evidence" *Social Science Quarterly*	68 798-815	Q: Do aging effects contribute to environmental concern? Employs national survey data to confirm Buttel's hypothesis that age is the strongest predictor of environmental concern. These age effects are quite independent of other influences.	1
Pollock, Cynthia	1987	"There's Gold in Garbage" *Across The Board*	24 28-38	General, descriptive, comparative discussion of U.S. and foreign recycling performance, and environmental and economic incentives for recycling.	3
Hodges-Copple, John	1988	"Minimizing Solid Waste" *Growth and Environmental Management*	1 1-22	Reviews waste management strategies in the South (*i.e.*, source reduction, recycling, reduction by treatment, and waste disposal). While states are moving from regulating bad practices to promoting desired ones, other approaches will be needed.	3
Kindel, Stephen	1988	"Taking Out the Garbage" *Financial World*	157 48-56	General review of the debate over the merits/demerits and economic consequences of incineration, landfills, and recycling. Author recommends regulations to promote best use of each approach and economic incentives (disincentives) for compliance.	2
Kovacs, William L. and Anthony A. Anderson	1988	"States as Market Participants in Solid Waste Disposal Services -- Fair Competition or the Destruction of the Private Sector?" *Environmental Law*	18 779-816	Examines Supreme Court market participation doctrine; expansion and limits that permit states to prohibit other states waste disposal within their borders; impacts on state/private sector competition. Critiques findings regarding state/private rights.	3
McEntee, Ken	1988	"Paper Recyclers Battle Effects of State Legislation" *Recycling Today*	26 26; 70-71; 96-97	General discussion of the market problems facing East Coast states having, or considering, mandatory waste paper recycling. Identifies key interests (cities, collectors, recyclers, state legislatures) and the political/market issues driving decisions.	3
Reaven, Sheldon	1988	"One Person's Opinion: We Need a Model Professional Recycling Curriculum" *Resource Recycling*	7 36-37; 66	Author proposes and details a 13-unit curriculum promoting the technical instruction, theoretical understanding, skills needed for dealing with individuals and groups, and analytical skills essential to career recycling managers.	3
Schwab, Jim	1988	"Waste Not, Want Not" *Planning*	54 16-19	Compares several cities that are recycling using either mandatory or voluntary programs. Suggests that, while some voluntary programs have had considerable success, mandatory programs are becoming more common.	2
Schwartz, Stephen C.; Harry G. Bhatt; and Sherri K. Hess	1988	"State of the Art of Recycling: Comparing Community Operations" *Recycling Today*	26 86-90	Case histories of recycling systems in eight communities. Authors suggest local choices will vary due to budget and equipment concerns; geographic distribution of the population; existing private sector operations; and unique community traits.	2
Spurr, Mark	1988	"Curbside Sampling of Recyclables" *Resource Recycling*	7 26-29	Q: How much, how many different kinds of materials are Minneapolis households recycling? Sampled materials set out for recycling in two neighborhoods. Found high participation, but limited numbers of different types of program materials being recycled.	3

Watson, Tom	1988	"Recycling at Crossroads in Chicago" *Resource Recycling*	7 22-23; 53, 55	General discussion of the evolution of recycling efforts in Chicago, and the perceived need for the city to develop the consensus needed to arrive at a comprehensive recycling strategy.	2
Byrd, Jacqueline; Robert Fulton; Terry Schutten; and Jon Walsh	1989	"Recycling Policy and Implementation Strategies for Recycling" *Resource Recycling*	October 34-58	Q: Why do/don't residents recycle; what, how frequently do they recycle; does recycling advertising have an impact? Surveyed one county before and after a public information campaign. Suggests need to stress environmental protection, monetary incentives.	2
Dunlap, Riley E.	1989	"Public Opinion and Environmental Policy" *in James Lester (ed.) Environmental Politics and Policy. Durham, NC: Duke University Press*	87-134	Q: To what degree does the public support environmental protection? Has support increased/decreased over 20 years? Uses several sets of trend data. Despite success in maintaining public support, environmental goals do not outweigh economic concerns.	1
Environmental Protection Agency	1989	"The Solid Waste Dilemma: An Agenda for Action" *Final Report of the Municipal Solid Waste Task Force Office of Solid Waste*		Presents data defining scope of the solid waste "dilemma," leading to the Task Force recommendation for a holistic integrated waste management system custom designed to meet local environmental, economic, and institutional needs.	2
Lewis, Jack	1989	"What's in the Solid Waste Stream?" *Environmental Protection Agency Journal*	15 (No. 2) 15-17	Descriptive presentation of aggregate data characterizing the solid waste stream, specifically concerning the materials, products and sources.	3
Office of Technology Assessment	1989	"Facing America's Trash: What Next for Municipal Solid Waste?" *U. S. Government Printing Office*		Extensive presentation of the national solid waste problem and policy options available for federal, state, local and intergovernmental action.	3
BioCycle	1996	"Chicago Board of Trade Recycling Exchange" *BioCycle*	(Oct.) 14	Update on efforts to make the Recyclables Exchange more user friendly, reduce subscriber costs, and improve commodity parameters for buyers and sellers. Changes are hoped to attract more users, contribute to better price discovery.	2
DeYoung, Raymond	1996	"Some Psychological Aspects of Reduced Consumption Behavior: The Role of Intrinsic Satisfaction and Competence Motivation" *Environment and Behavior*	28 358-409	Concept development. Suggests need to recognize and focus on 'competence motivation' in conservation behavior research. New focus on internal, intangible incentives may enhance strategies to emphasize conservation behavior.	1

Fullerton, Don and Thomas C. Kinnamon	1996	"Household Responses to Pricing Garbage by the Bag" The American Economic Review	86 971-984	Q: What is the household response to unit pricing on the weight of garbage, the number of containers, the weight per container, the amount of recycling, and illegal dumping? Use pre- and post-test experimental data from the Charlottesville, VA program to charge $0.80 per bag or can of garbage collected at the curb. Counted and weighed garbage and recyclables from 75 randomly selected (although unrepresentative of the population as a whole) households for four weeks before and four weeks after program implementation. Findings: The average household member reduced the weight of their garbage by 14%, reduced the volume of their garbage by 37%, and increased the weight of recyclables by 16%. The measures for illegal dumping, however, suggest 28 to 43% of the reduction in garbage may be accounted for by illegal dumping or burning. While the weight reduction in household garbage was statistically significant, it was also small. In addition, many households already participated in voluntary recycling before the program began. Authors conclude that the incremental benefit of unit-pricing is limited, and "that the social benefit does not cover the administrative cost" (983).	1
Giltenan, Ed	1996	"Ups and Downs of Recycling" *Chemical Marketing Reporter*	2509	Q: What factors have contributed to the collapse of secondary fiber markets? What are the prospects for the future? Presents aggregate data and discussion of factors affecting the fiber market. Suggests that industry downturn, decline in consumer "infatuation" with recycling, increased use of coated paper in publishing/printing, and decline of newsprint has led to: reduced availability and less inclination to pay premium prices for recycled newsprint. Also, unfavorable economics (reduced demand, unreasonable growth in prices/industry capacity, demand for higher quality) are the key problems. Suggests, however, that long-term demand is still strong; new technology will help wastepaper compete with virgin pulp quality; better collection methods are leading to larger volumes of mixed- and high-grade paper collection. Good markets will return for secondary fibers.	3
Luton, Larry S.	1996	" The Politics of Garbage" *Pittsburgh, PA: University of Pittsburgh Press*		Q: How are factors involved in solid waste policymaking related? Case study of Spokane, WA informed by systems theory to understand SW policymaking process. Assesses influence of political culture, local political system, intergovernmental relations, economic influences, public participation, and the media. Findings suggest the value of the systems model for improved understanding of solid waste policy making.	3
Ackerman, Frank	1997	"Why Do We Recycle?" *Washington, DC: Island Press*		Q: Why do we recycle? Discussion of the debates regarding recycling and the economic/environmental costs/benefits; the research and policy concerning packaging; and suggestions regarding future waste reduction and materials policy. Findings suggest support for recycling is not understandable solely in terms of financial incentives. Suggests revision of textbook consumption models to reflect reality that there is "such a thing as enough," and that many needs must be satisfied through social change rather than private spending. And textbook images of people as effort minimizers are misleading. The urge to recycle should include the understanding that individual actions do express responsibility and responsiveness.	3
Horrigan, Alice and Jim Motavelli	1997	"Talking Trash" *E Magazine*	(Mar/Apr) 28-35	Q: What are the pros and cons of recycling? General discussion of the debate over recycling. Conclusion suggests reuse makes more sense than waste.	3
Palmer, Karen; Hilary Sigman; and Margaret Walls	1997	"The Cost of Reducing Municipal Solid Waste" *Journal of Environmental Economics and Management*	33 128-50	Q: What are the least/most cost efficient of three price-based policies for solid waste reduction? Authors develop a model of waste disposal using supply and demand elasticities and 1990 prices for aluminum, glass, paper, plastic, and steel to evaluate the cost effectiveness of deposit/refund fees, advance disposal fees, and recycling subsidies. Employ data from previous empirical studies and 1990 price and quantity data for each type of material. Findings: Results suggest there are "substantial" differences in the levels of intervention needed to reduce waste disposal with various policies. A $45/ton deposit/refund reduces all wastes in the model by 10%, while it would require an advance disposal fee of $85/ton or a recycling subsidy of $98/ton to achieve comparable reductions. Comparisons of policies that set common waste reduction targets for specific materials and least-cost approaches permitting larger reductions in some materials than other finds that setting goals for individual materials is more costly than establishing a single disposal price for all materials. Authors suggest the need for more research on the social benefits of waste reduction to address uncertainty about the benefits of waste reduction vs. its marginal costs.	3

Appendix A

Publication Name

Administration and Policy Journal
Administration and Society
Administrative Management
Administrative Science Quarterly
American Academy of Political and Social Science
American Behavioral Scientist
American City and County
American Economic Review
American Journal of Political Science
American Journal of Sociology
American Political Science Review
American Politics Quarterly
American Psychologist
American Review of Public Administration
American Sociological Review
Amicus Journal
Annals of Public Administration
Annals of Regional Science: International Journal of Urban Regional and Environmental Research and Policy
Annals of the American Academy of Political and Social Science
Applied Economics
Atlantic Economic Journal
Behavioral Science
Biocycle
Bioscience
California Management Review
Canadian Journal of Economics
Canadian Journal of Regional Science
CATO Journal
Columbia Journal of Environmental Law
Contemporary Policy Issues
Decision Sciences
Eastern Economic Journal
Ecology Law Quarterly
Economic Review
Energy Economics
The Energy Journal

Energy Systems and Policy
Environment
Environment and Behavior
Environment and Planning
Environmental Action
Environmental Forum
Environmental Law
Environmental Planning
EPA Journal
Evaluation
Evaluation and Program Planning
Evaluation Review
Forum for Applied Research and Public Policy
Good Government
Governing the States and Localities
Government Finance Review
Harvard Journal on Legislation
International Journal of Public Administration
Issues in Science and Technology
Journal of Accounting and Public Policy
Journal of Air and Waste Management
Journal of Applied Behavioral Science
Journal of Consumer Affairs
Journal of Economic Literature
Journal of Environmental Economics and Management
Journal of Environmental Management
Journal of Environmental Planning and Management
Journal of Environmental Systems
Journal of Policy Analysis and Management
Journal of Politics
Journal of Public Administration
Journal of Public Administration: Research and Theory
Journal of Public Economics
Journal of Public Policy
Journal of Regulatory Economics
Journal of Regulatory Science
Journal of Social Issues
Journal of Socio-Economics

Journal of the American Planning Association
Journal of the American Institute of Planners
Journal of Voluntary Action Research
Journal of Volunteer Administration
Land Economics
Law and Society Review
Maxwell Review
Midwest Review of Public Administration
National Cities
National Civic Review
National Journal
National Tax Journal
Natural Resources Journal
Non-Profit and Voluntary Sector Quarterly
Operations Research
Planning
Policy Sciences
Policy Studies
Policy Studies Journal
Policy Studies Review
Political Research Quarterly
Population and Environment
Public Administration Quarterly
Public Administration Review
Public Administration Times
Public Choice
Public Finance Quarterly
Public Management
Public Management Series
Public Opinion Quarterly
Public Policy and Administration
Public Productivity Review
Publius: The Journal of Federalism
Resource and Energy Economics
Resource Recycling
Resources
Resources Conservation and Recycling
Sage Professional Papers in Administrative and Policy Studies

Sage Yearbooks in Politics and Public Policy
Scientific American
Social Science Quarterly
Society
Southern Review of Public Administration
Spectrum (Journal of State Government)
State and Local Government Review
State Legislatures
Technology Review
The Economist
Municipal Yearbook
Urban Affairs Annual Reviews
Urban Affairs Quarterly
Urban Research News
Urban Research Reports
Voluntary Action Leadership
Waste Age
Western Political Quarterly
World Bank Research Observer
World Watch

Appendix B

Glossary Terms
(Note: Some definitions copied from *Decision-Maker's Guide to Solid Waste Management, Second Edition*, U.S. EPA: OSWER, EPA530-R-95-023, August 1995)

Advance disposal fee: Fee charged to retail items that reflects incremental disposal costs.

Bag method: Feature of solid waste collection programs requiring residents to purchase bags used exclusively for waste disposal and/or recycling.

Bin method: Feature of recycling programs that issue/sell bins to residents for curbside collection of recyclables. Depending on the program, bins may be designated for commingled or separated recyclables.

Bottle bill: A law requiring deposits on beverage containers (see Container Deposit Legislation).

Buy-back center: A facility to which individuals bring recyclables in exchange for payment.

Commingled recyclables: Two or more recyclable materials collected together (i.e., not separated). In some types of collection programs, recyclable materials may be commingled, as long as they do not contaminate each other. For example, glass and plastic can be commingled, but glass and oil cannot.

Curbside collection: Programs in which recyclable materials are collected at the curb, often from special containers, and then taken to various processing facilities.

Diversion rate: The amount of material being diverted for recycling, compared to the total amount that was previously disposed of.

Drop-off collection:	A method of collecting recyclable or compostable materials in which the materials are taken by individuals to collection sites, where they deposit the materials into designated containers.
Generation rate:	The amount of waste that is produced over a given amount of time. For example, a district may have a generation rate of 100 tons per day.
Incinerator:	A facility in which solid waste is combusted.
Integrated solid waste management (ISWM):	A practice using several alternative waste management techniques to manage and dispose of specific components of the municipal solid waste stream. Waste management alternatives include source reduction, recycling, composting, energy recovery, and landfilling.
Level of recycling:	Generally refers to quantity/volume of recyclables collected.
Mandatory recycling program:	Recycling program that imposes legal requirement on residents to separate recyclables from their solid waste.
Marginal social cost:	Incremental cost of production or consumption that includes private (market) costs and the value of any externalities.
Marginal social benefit:	Incremental benefit of production or consumption that includes private (market) benefits and the value of any externalities.
Mobile drop-off system:	Drop-off recycling program using portable mobile collection units.
Municipal solid waste (MSW):	MSW means household waste, commercial solid waste, nonhazardous sludge, conditionally exempt

small quantity hazardous waste, and industrial solid waste.

Negative externality: A condition where marginal social cost exceeds marginal private cost (or where marginal private benefit exceeds marginal social benefit) resulting in a spillover or non-market cost or benefit. Pollution is normally thought of as creating a negative externality.

Participation rate (recycling): Percentage of eligible households that actively participate in the recycling program.

Pigouvian tax: An optimal emissions tax or fee equal to the divergence between marginal social cost and marginal private cost at the socially desirable level of production or consumption.

Plastic bag collection system: MSW program requirement that waste and recyclables be disposed of with plastic bags (as opposed to cans, bins, etc.). Programs may or may not include features of the bag method.

Recycling: The process by which materials otherwise destined for disposal are collected, reprocessed, or remanufactured, and are reused.

Recycling level: Measure of the amount of materials recycled relative to the total solid waste stream (often measures in tons or as a percentage).

Residential waste: Waste generated in single- and multiple-family homes.

Solid waste: Any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or

contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. 1342, or source, special nuclear, or by-product materials as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923). (Definition from 40CFR 258.2.).

Source reduction: The design, manufacture, acquisition, and reuse of materials so as to minimize the quantity and/or toxicity of waste produced. Source reduction prevents waste either by redesigning products or by otherwise changing societal patterns of consumption, use, and waste generation. (See also, "waste reduction.")

Source separation: The segregation of specific materials at the point of generation for separate collection. Residential generators source separate recyclables as part of curbside recycling programs.

Tipping fee: A fee charged for the unloading or dumping of material at a landfill, transfer station, recycling center, or waste-to-energy facility, usually stated in dollars per ton. (Sometimes called a disposal or service fee).

Unit-pricing: Generic name for various incremental pricing schemes.

Variable disposal fee: Service based charges for solid waste disposal that may include variable disposal fee systems and quantity-based tipping fees.

Volume-based fees: Volume-based pricing scheme for solid waste disposal.

Waste reduction: Waste reduction is a broad term encompassing all waste management methods—source reduction, recycling, composting—that result in reduction of waste going to a combustion facility or landfill.

Waste stream: A term describing the total flow of solid waste from homes, businesses, institutions and manufacturing plants that must be recycled, burned, or disposed of in landfills; or any segment thereof, such as the “residential waste stream” or the “recyclable waste stream.”