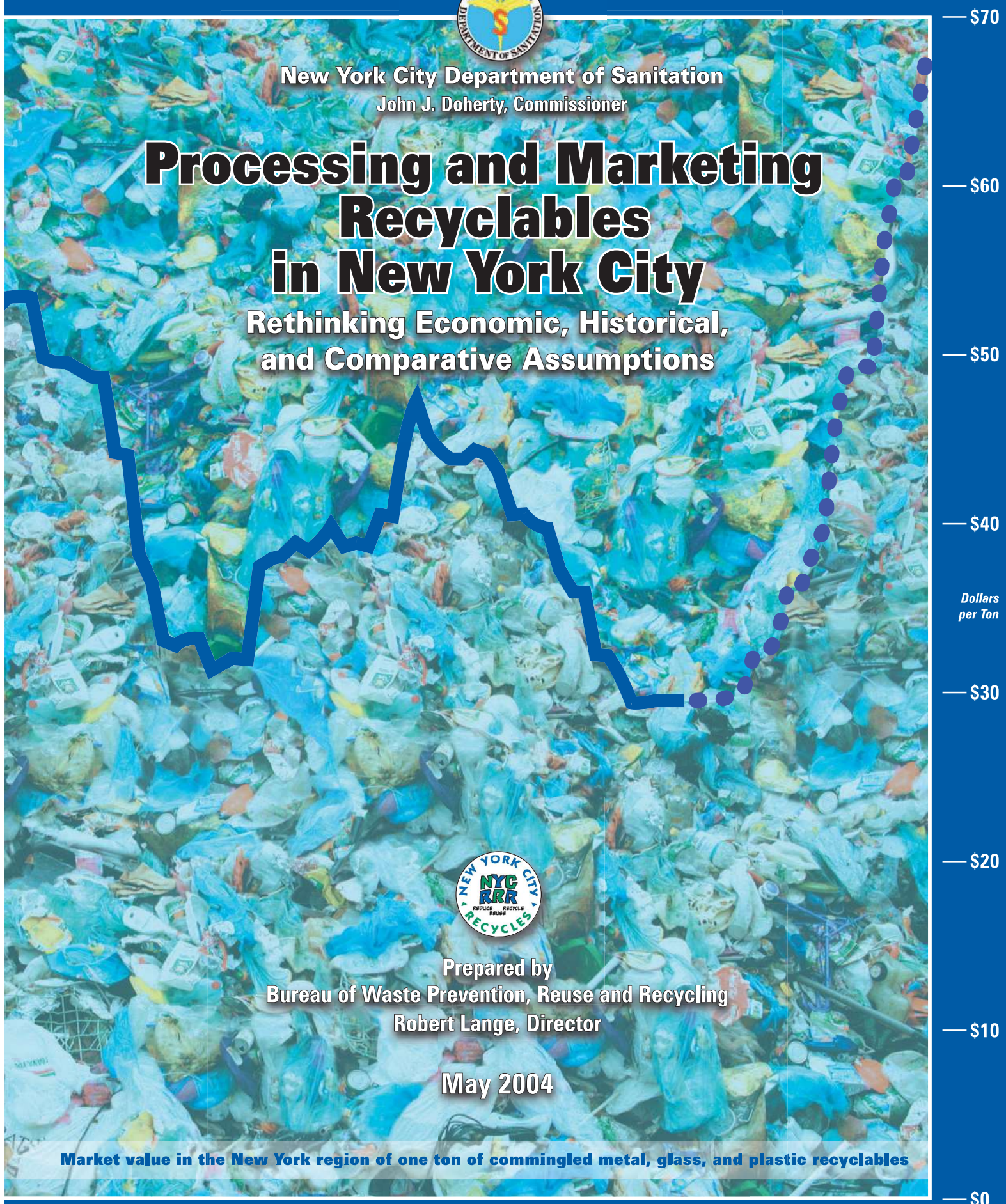
New York City Department of Sanitation

John J. Doherty, Commissioner

Processing and Marketing Recyclables in New York City

Rethinking Economic, Historical, and Comparative Assumptions



Market value in the New York region of one ton of commingled metal, glass, and plastic recyclables

Prepared by

Bureau of Waste Prevention, Reuse and Recycling

Robert Lange, Director

May 2004

New York City Department of Sanitation
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About the cover: The cover shows the volatile market price of an average ton of NYC commingled recyclables between 1991 and June 2002. The dotted line indicates prices extrapolated to 2004 although only metal was collected between July 2002 and June 2003; and only metal and plastic were collected between July 2003 and March 2004.

The graph reflects market prices for secondary, post-consumer metal, glass, and plastic in the New York area, as published in *Recycling Manager,* a trade publication, adjusted to account for the composition of NYC's commingled stream, as follows: Brown glass, 2.00%; Green glass, 5.00%; Clear glass, 10.00%; Mixed cullet, 40.93%; Used steel/bimetal cans, 17.28%; Aluminum cans/foil, 0.67%; Mixed HDPE, 5.35%; Natural HDPE, 1.32%; Mixed PET, 2.45%; Residue, 15.00%. This composition is an estimate used for demonstration purposes only. The market price is shown without including collection, processing, or other associated recycling costs.

The data are presented against a backdrop of a photo of NYC commingled metal, glass, and plastic taken in 2001.

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New York City Department of Sanitation, Office of Operations Planning, Evaluation, and Control, *New York City Recycling Strategy White Paper*, January 1988.

New York City Department of Sanitation, Office of Operations Planning, *Preliminary Recycling Plan, Fiscal Year 1991*.

New York City Department of Sanitation, *A Comprehensive Solid Waste Management Plan for New York City and Final Generic Impact Statement*, August 1992.

New York City Department of Sanitation, *A Comprehensive Solid Waste Management Plan for New York City and Final Generic Impact Statement, Appendix Volume 4.1, Waste Management Components*, August 1992.

Urban Research Center, New York University/Appleseed for the New York City Department of Sanitation, *Exploring Economic Development Opportunities in Recycling*, August 1993.

Director's Note

Since New York City's Recycling Law (Local Law 19) passed in 1989, much discussion and debate has focused on the *front* end of the municipal recycling process—participation, public education, and the diversion rate.

In recent years, there has been public concern about the under-performance of low-diversion districts, and a great deal of interest in how New York City's overall diversion rate compares to other jurisdictions. In the mid-1990s, the Natural Resources Defense Council (NRDC) brought a series of suits against the City for failing to attain tonnages mandated in Local Law 19 of 1989, and to ensure that the City does not include in its diversion figures the reuse and recycling of millings and construction debris. During this period, attention was also focused on the Department's public education programs and efforts.[1]

But what are the overall economic structures that are needed to keep recycling functioning in New York City? In other words, what does it take to make recycling work after residents place materials at curbside? *Processing and Marketing Recyclables in New York City* seeks to address this underexamined area. Its core argument is that the material qualities of residential recyclables in New York City, as well as the volatile nature of recycling markets, make securing stable, long-term, primary processing capacity *the most crucial aspect* to ensuring the viability of recycling in the City's future.

This report makes the case that firms who undertake the challenge of primary processing have to be prepared for a massive stream of mixed materials that will—as in all megacities[2]—contain contamination. And they must understand that the recycling economy is multi-scalar; to work locally, it also has to work nationally and globally. For better or worse, cities in today's world are, in the words of one political scientist, "glocal."[3] This argues against economic development plans where the success or failure of recyclers and remanufacturers rides on their ability to buy and sell within New York City limits only.

Even though April 2004 saw the full return of NYC's recycling program, the future of recycling continues to be debated among citizens, environmental groups, legislators, public officials, and waste-related businesses that together contribute to waste policy in New York City. Decisions about how to best strengthen recycling in New York City require a solid understanding of the economic, political, and historical background of recycling in the City. The goal of this report is to contribute to this understanding.

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Photos 3-3, 3-4, 3-5, 3-6, 3-7, and 3-9—Norcal Waste Systems, Inc.

Seattle
Photo 3-24—Seattle Public Utilities

Other
Photo 1-4—Phoenix Recycling Inc.
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Abbreviations and Definitions

AC	Asphalt Concrete
automated collection	Collection carried out using a mechanized arm or other device that lifts waste carts, tips contents into trucks, and replaces waste carts
beverage cartons	Laminated-paper beverage receptacles, including gable-top milk and juice cartons and aseptic containers
BFI	Browning-Ferris International
BWPRR	Bureau of Waste Prevention, Reuse and Recycling (formerly known as the Recycling Programs and Planning Division)
C&D	Construction and Demolition debris
capture rate	Percentage of items recycled out of all the recyclables present in the waste stream. The amount of recyclables in the waste stream is based on waste-composition sampling.
CENCY	Council on the Environment of New York City
CIWMB	California Integrated Waste Management Board
Community District/ Sanitation District	One of the 59 administrative districts of NYC whose Boards advise Borough Presidents and City agencies on planning and services. Sanitation Districts, designated by the NYC Department of Sanitation for operational/administrative purposes, contain the same boundaries as community districts.
contamination	The presence of materials not designated for recycling in and among collected recyclables. These materials may include nondesignated plastics, food residues, and refuse items.
curbside	A form of waste collection that entails the set out of refuse or recyclables in cans, bins, carts, bags, or bundles adjacent to houses, buildings, or other structures, but most frequently on the curbside facing such structures, for manual, semi-automated, or automated collection
DCAS	NYC Department of Citywide Administrative Services
DEC	New York State Department of Environmental Conservation

diversion rate	The portion of total discarded materials collected by the NYC Department of Sanitation that is diverted from disposal through recycling or composting. The diversion rate is measured by dividing the weight of collected recyclables by the weight of collected refuse plus recyclables.
DOT	NYC Department of Transportation
DSNY	NYC Department of Sanitation
DSS	Department of Streets and Sanitation (Chicago)
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ESDC	Empire State Development Corporation
glassphalt	Asphalt that is created using mixed cullet glass as one of the inputs
HDPE	High-density polyethylene, one of the resins collected by DSNY for recycling
ILSR	Institute for Local Self-Reliance
IPC	Intermediate Processing Center, also referred to as MRF
LDC	Local Development Corporation
linerboard	The smooth layer of facing on corrugated cardboard
Local Law 19	Local law passed in 1989 establishing New York City's residential and institutional recycling program
Local Law 11	Local law passed in 2002 temporarily suspending plastic, glass, and beverage carton collection from the Recycling Program
low-diversion district	Sanitation Districts with diversion rates below 12 percent
MFA	Materials For the Arts
MGP	Commingled household metal, plastic jugs and bottles, glass bottles and jars, and beverage cartons collected under DSNY's curbside and containerized recycling program
mixed cullet	Small pieces of mixed glass of various colors

MP	Commingled household metal, plastic jugs and bottles, and beverage cartons collected under DSNY's curbside and containerized recycling program
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MTS	Marine Transfer Station
municipal solid waste	Refuse and recyclables generated by residents and public/nonprofit (institutional) entities
NDCA	Neighborhood Dry Cleaners Association
NRDC	Natural Resource Defense Council
NYCEDC	NYC Economic Development Corporation
NYPIRG	New York Public Interest Research Group
NYU Report	Hugh O'Neill and Meghan Sheehan, *Exploring Economic Development Opportunities in Recycling*, Urban Research Center, New York University/Appleseed, 1993
OPEC	DSNY Office of Operations, Planning, Evaluation and Control
ORMD	Office of Recycling Market Development within the Empire State Development Corporation. This work is now handled by the Environmental Services Unit of the same organization.
PET	Polyethylene Terephalate, one of the resins collected by DSNY for recycling
post-consumer recyclables	Recyclables collected from residents, institutions, or commercial sources after they have been used
primary processing	First step in processing recyclables in which they are sorted and readied for marketing
processing	An operation or series of operations that enhances, sorts, cleans, or otherwise prepares recyclables for marketing
processor	Firm that engages in processing
RAP	Recycled Asphalt Product
RCRA	Resource Conservation and Recovery Act

recyclables	Paper and MP, MGP, or any combination of metal, glass, plastic, and beverage cartons designated under the curbside and containerized recycling program and set out by residents and institutions, whether sorted or unsorted, loose, bundled, bagged or baled, and any contamination contained therein
recycle or recycling	Any process by which waste is separated, collected, processed, marketed, and returned to the economy in the form of raw materials or products, including but not limited to metal, glass, paper, plastic, food waste, yard waste, and tires
recycling program	The DSNY-managed program for the curbside and containerized collection of designated materials
refuse	All putrescible and non-putrescible materials or substances that are discarded or rejected as being spent, useless, worthless, or in excess to the owners at the time of such discard or rejection, unless expressly exempted as such in Local Law 19
resin	Category of plastic, used to denote chemical composition
reuse	Separating, collecting, repairing, marketing, and returning a product or item to the economy in its original form, or after it is repaired or otherwise reconditioned. Reuse does not include recycling.
RPPC	Rigid Plastic Packaging Containers
SAIC	Science Applications International Corporation
secondary materials	Processed recyclables that are sold on markets
semi-automated collection	Collection carried out using a mechanized arm or other device that assists personnel to lift waste carts or bins
SPU	Seattle Public Utilities
SWMP	New York City Solid Waste Management Plan
the "Program"	NYC recycling program
ULURP	Uniformed Land Use Review Procedures
waste	All refuse and recycling generated by residents, institutions, commercial sources, and/or industrial processes

waste prevention	The practice of reducing waste by preventing its creation. This includes: buying products that have the least amount of packaging or are packaged to last longer; not buying more of a product than needed; reusing, donating, or repairing items that might otherwise be discarded as trash or for recycling.
WMI	Waste Management, Incorporated
WTE	Waste-to-energy; incineration with energy recovery
yard waste	Waste comprising leaves, brush, trees, grass clippings, earth, or other organic debris from yard or gardening work

Introduction

At the dawn of the 21st century, New York City has the largest municipal waste stream in the country. In 2003, NYC residents and institutions disposed of 3.3 million tons of refuse, and recycled about 430,000 tons, a figure that was down from previous years due to the temporary suspension of glass from NYC's recycling program.[1] In 2001 and 2000, New Yorkers had recycled around 690,000 tons of paper, metal, glass, and plastic annually. The reintroduction of glass recycling in April 2004 set the stage for returning to these tonnage levels, with the diversion rate rebounding from a low of around 12 percent in March 2004 to over 17 percent two months later.

How the System Works in New York: Municipal Collection and Private Processing

Managing NYC's large tonnages of recovered materials takes place within a framework that involves both City government and the private sector. The New York City Department of Sanitation ("the Department" or DSNY) collects recyclables from NYC residents and institutions, and trucks them to processing facilities operated by private firms who hold contracts with the Department.

Once residential[2] recyclables are delivered to private contractors, they move out of the hands of the public sector. The firms that own and operate the processing facilities take responsibility, both operationally and financially, for preparing recyclables for use as feedstock in the manufacturing process. In this way, the newspaper, cans, and other recyclables separated at home are eventually used to make new products.

Utilizing the private sector in this way has clear benefits, such as the infrastructure and technologies that private recyclers have built up locally, regionally, and nationwide over the last 20 years. But reliance on the free market brings with it major challenges as well. The dollar value of a ton of New York City's paper, metal, or plastic frequently changes. Prices are based on the global supply of and demand for such materials at any given time.

While recyclables may seem to be "there for the taking" from our garbage—readying them for use in manufacturing or other production processes costs a significant amount of money. And because of market volatility, there are periods in which these costs are not mitigated by the sale of processed recyclables. This makes for a rough ride for the businesses trying to make a living in materials recovery. It also places competing priorities on New York City's waste-management system.

DSNY Recycling Processors as of May 2004

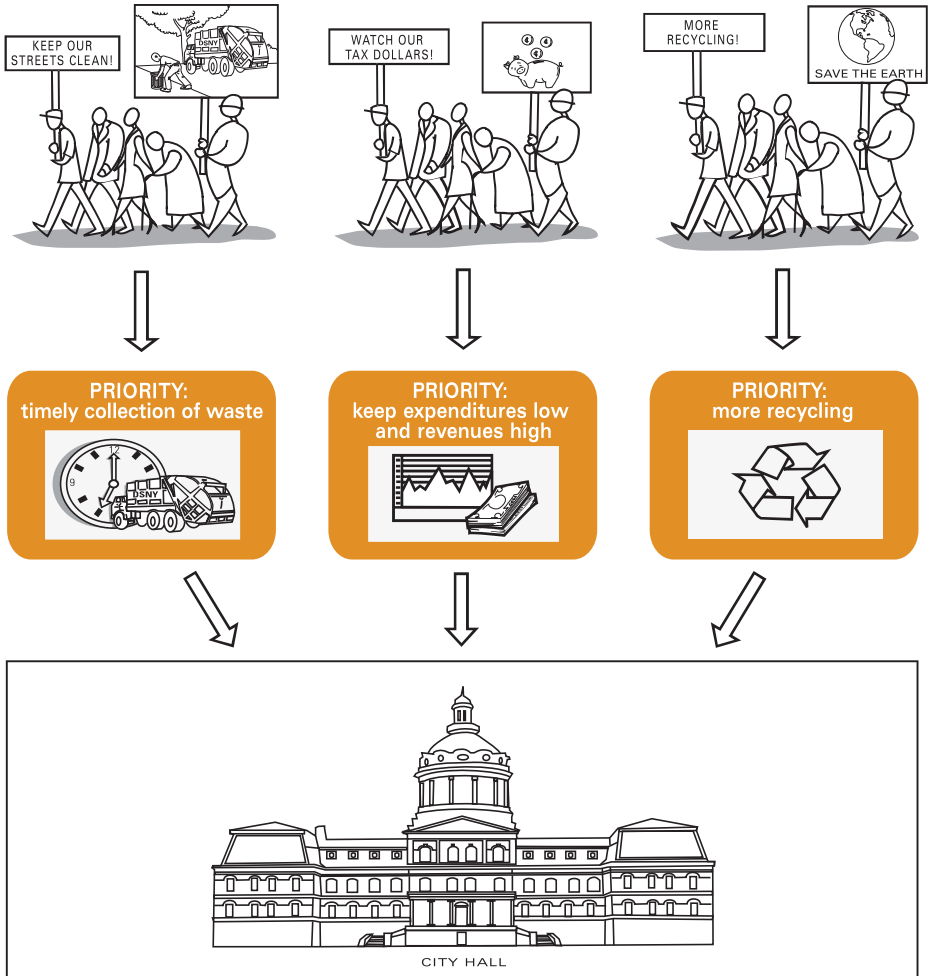
Paper Processors:
Approximately half of the DSNY-collected mixed paper goes to five processing facilities, which sort, bale, and resell it to paper brokers or manufacturers. The other half goes to Visy Paper, located on Staten Island, which manufactures linerboard for corrugated cardboard boxes.

Metal, Glass, and Plastic Processors:
All of the MGP collected by DSNY (which also includes beverage cartons and drink boxes) goes to three sites in and around the New York area run by Hugo Neu Schnitzer East. DSNY is in the midst of negotiating a long-term MGP processing contract. When contract negotiations are complete, New York City can look forward to a new, state-of-the-art facility that is located within city limits and is accessible by truck and barge.

Municipalities and the Market

City government is under intense—and justified—pressure from citizens to move waste (both trash and recycling) off the curb and out of the city on a daily basis. At the same time, it must respond to the very widespread support that recycling enjoys among the public, regardless of the state of markets. And all the while, it is accountable for the wise use of taxpayer funds. Yet as a direct or indirect seller of recycled materials, a municipality faces market uncertainties far beyond its control (Figure 1).

Figure 1
Competing Priorities for Municipalities



"Timely Collection of Waste" vs. **"More Recycling"**
In a dense city like New York, collecting paper and commingled recycling separately from refuse is slower than collecting all waste together, and requires more equipment and labor, spreading resources thin.

"More Recycling" vs. **"Keeping Expenditures Low and Revenues High"**
Collecting, transporting, and processing recyclables usually costs more than collecting, transporting, and disposing of all waste, especially when recycling markets are bad.

"Timely Collection of Waste" vs. **"Keeping Expenditures Low and Revenues High"**
Devoting more resources to the collection of recycling and refuse is necessary to provide timely collection of waste, but this raises expenditures.

These competing priorities make it extraordinarily challenging to operate recycling programs in a cost-effective and yet environmentally sound manner. One method to meet this challenge is through long-term service contracts, entered into with one or more private processors.[3] Many cities require processors to accept a certain tonnage of recyclables every day or face large penalties. Often contracts require processors to accept low-value commodities (like glass) if they want access to high-value materials like aluminum. And most contracts set floor and ceiling prices for commodities that insulate both parties from market fluctuations.

Floor and Ceiling Prices in Processing Contracts: How They Work

Prior to finalizing a contract, the municipality and the processor agree on a floor and ceiling price for each ton of processed recyclables. Depending on the value of what is being recycled, the floor and ceiling prices may be negative (the municipality pays the contractor to take recyclables) or positive (the contractor pays the municipality).

This arrangement protects the municipality from having to pay large amounts to processors to accept low-value material during bad economic times. Conversely, the use of the ceiling means that in a boom market, the contractors can reap the rewards. Both parties are insulated against market volatility.

Arrangements that legally bind contractors to work with the municipality for significant periods of time can ensure that, in the long term, the municipality will save money by recycling, and also that recyclables will truly be put to beneficial use. In fact, the history of residential recycling over the past decade in NYC has shown that short-term contracting inhibits private investment in infrastructure and technology, and limits the pool of interested bidders.

In the first decade of New York City's recycling program, it was necessary to bid out one-, and then five-year contracts to keep materials moving under less-than-optimal materials-recovery arrangements. Now, however, DSNY seeks wherever possible to structure contracts that—barring major problems—give firms a twenty-year time line upon which to plan business. Such contracts are currently in place with Visy Paper on Staten Island and can be used as a model for other relationships.

The Importance of Long-term Primary Processing Capacity

Nonetheless, residential recycling will sometimes be costly—sometimes far more so than waste disposal—depending on how refuse collection and disposal costs stack up against those for recycling collection and processing. And if strong markets for a particular material are not there, it will be prohibitively expensive to recycle components of the waste stream that can, in theory, be recycled. Moreover, the massive tonnages generated in New York City each day mean that only processors with large capacity and flexible operations will be able to adequately respond to the Department's deliveries. Such realities set very real constraints on recycling in the New York City context.

At the same time, there are more and less favorable forms of large, flexible, primary processing capacity. More often than not, when waste-management companies provide municipalities with this kind of processing, such services act as "add ons" to their primary business of waste transport, transfer, and disposal. In fact, many waste-management companies have increased their profits by buying landfills around the country in order to more efficiently move residential garbage from curbside to final disposal. For this reason, even though such companies offer recyclables processing, they lack profit incentives to maximize the amount of recyclables recovered because they can earn more by simply disposing of these materials.

In contrast, more cost-effective large, flexible processing capacity tends to be provided by companies whose primary focus is materials recovery, instead of waste disposal. For these companies, there is a built-in incentive

to minimize what is not recycled, and maximize what is. Such companies include traditional scrap-recovery operations, as well as newer, recovery-focused industries.

Recycling is a constantly evolving economic process. The volunteer-based community recycling centers that started in the 1970s gave way to municipal-scale recycling programs in the late 1980s. As soon as these programs were underway, waste-management companies rushed to capitalize on the large tonnages of materials collected at public expense. By and large, this was the order of business in the 1990s.

Today, the waste industry is consolidating, and waste management costs are rising. But a new breed of recycling processor is stepping up to the plate, combining a 1970's-style dedication to recycling with solid business experience and a capacity to turn a profit through resource recovery. In New York City, Hugo Neu Schnitzer East, a large, scrap-metal–recovery company, is an example of this new breed. The firm's size, marketing expertise, and background turning scrap into commodities make it well qualified to handle NYC's residential material, which it has processed since 2002. A contender for the long-term contract to be awarded in the near future, Hugo Neu Schnitzer East signals a new age for recycling where companies no longer struggle to succeed through ever-growing subsidies, but instead find ways to integrate recycling into the business fabric of New York City's economy.

This report examines how New York City got to this point, and why it still faces considerable recycling challenges in years to come. The chapters cover current recycling economics, the history of New York City's recycling program in light of such economics, and an in-depth comparison of NYC to several large U.S. cities. The information presented points to some clear conclusions:

- The top priority for recycling policy development in New York City should be securing large-scale, technologically advanced, primary processing capacity.

- The economic development initiatives that will help New York City maximize diversion will be those that facilitate the location and/or development of such primary processing capacity in or near the City.

- In order to be successful, such initiatives should involve companies whose focus is materials processing and not waste disposal, and who have the expertise to market NYC recyclables globally, nationally, and regionally, as well as locally.

- In the short and medium term, it will be far wiser to capitalize upon existing infrastructure and business experience, rather than as yet unbuilt, unproven, or unestablished ventures.

To help put this information in context, the report presents various appendices that describe state recycling goals (Appendix I); comparative studies on recycling rates and costs (Appendix II); waste-prevention policy and planning (Appendix III), public education about recycling (Appendix IV); NYC recycling data for 2002 (Appendix V), and comparative recycling data for Chicago, Los Angeles, New York, San Francisco, and Seattle (Appendix VI).

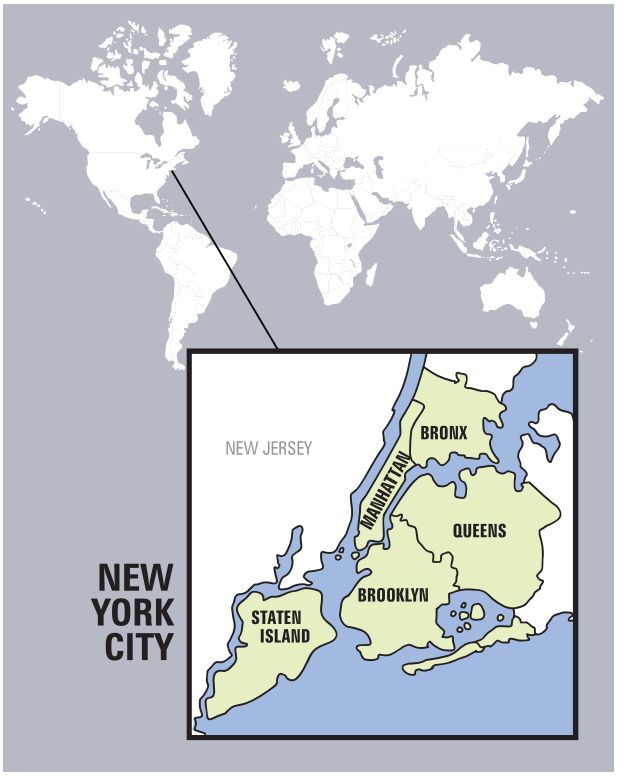
In addition, the CD that accompanies this report contains historical documents from the early years of NYC's recycling program: *New York City Recycling Strategy White Paper* (1988); *Preliminary Recycling Plan* (1990); sections from the 1992 *Comprehensive Solid Waste Management Plan*; and the 1993 New York University Report, *Exploring Economic Opportunities in Recycling*.

Chapter 1
RECYCLING ECONOMICS

New York City's economy is linked in complex ways to regional, national, and global networks of production, trade, and consumption (Graphic 1-1). By and large, NYC's economy follows the rules and tendencies of the U.S. economy as a whole, which itself has unique characteristics among advanced industrial nations.

In contrast to countries in Europe, Canada, and Australia, the U.S. government at all levels tends to refrain more from intervention in the private marketplace. There is a strong belief in the U.S. that the private sector can and should deliver as many services as possible. In fact, privatization of what were traditionally public works and services has been a growing trend in U.S. municipalities since the 1980s. Despite our many land-use regulations, approaches to urban planning in the U.S. tend to be driven much more by entrepreneurial investment and the laws of supply and demand than in other Western nations.[1] Not surprisingly, this economic climate affects the way cities recycle.

Graphic 1-1
NYC in Global Context



The Recycling Market

Although recycling has wide-ranging social and environmental benefits, it is important to understand that market exchange—over and above citizen participation or government support—is what makes it possible in the United States. Without businesses interested in buying recycled materials (Photo 1-1, page 18), residential recycling programs would soon grind to a halt, no matter how well-organized or popular they might be. And while it is true that community recycling emerged in the 1960s and 1970s as a grass-roots movement based on moral concern for the environment, by the 1980s it had become evident that, as one journalist put it, recycling:

> involves much more than the curbside collections of newspapers, bottles, and cans that are becoming a familiar feature of life in much of urban and suburban America. While necessary and critical, that is only the first step, one that becomes futile unless the materials can also be reprocessed, sold and recast into new products.[2]

Photo 1-1

Pictures of some processed NYC recyclables (clockwise from top left): paper, metal, plastic, and glass

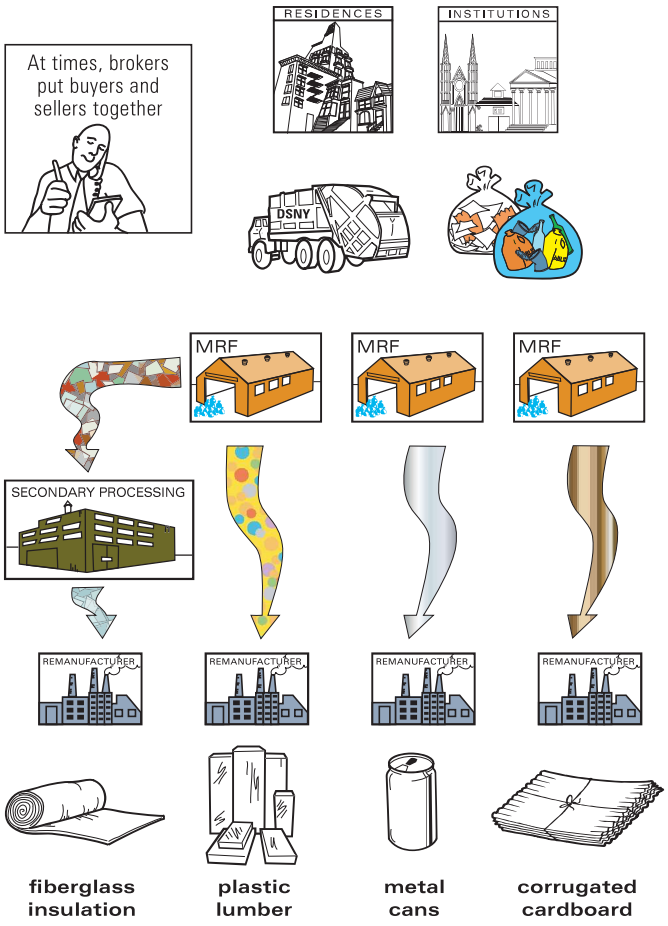
For this reason, it is useful to think about recycling in market terms. Municipalities, or carters who collect recyclables, are the "sellers" in this market. Buyers include:

- **Brokers** who specialize in buying, holding, and selling recycled materials to manufacturers or processors
- **Intermediate or "secondary" processors** who "clean up" recyclables and resell them at a profit to manufacturers
- **Manufacturers** who use recycled inputs in production

This meeting of seller supply and buyer demand—interacting over time through the mechanism of exchange—creates the recycling market (Figure 1-1). In this regard, recycling markets are like markets for anything else. Just what is sold in these markets? In the United States as elsewhere, established markets exist for certain components of residential municipal solid waste (Table 1-1, page 20).

The term "established markets" means that there is a sizeable group of potential buyers and sellers of a given commodity, who exchange it consistently. The term does not cover the many additional end uses of secondary materials for which markets are not well developed. These include substances for which recycling technologies exist, but which rarely can be operated at a profit—at least today. While public subsidy or unusual local economic conditions can sustain recycling of such materials at certain times and places, there are far fewer incentives for recycling companies to become engaged in processing them. Currently, common materials fitting this description include those listed in Table 1-2 (page 20).

Figure 1-1
Buyers and Sellers in the Market for Municipal Recyclables



Residences and public institutions receive recycling collection service from municipalities.

⇩

Municipalities (or the private carters that contract with them) collect recyclables to **sell** to firms that operate materials-recovery facilities (MRFs). (*See note below on Positive and Negative Prices.*)

⇩

Firms operating materials-recovery facilities **buy** recyclables, preparing (sorting, cleaning, and baling) the materials for **sale** at a higher price. This first stage of processing recyclables is called *primary processing*.

⇩

Sometimes other firms **buy** partially sorted recyclables for further (secondary) processing. This is often the case with glass.

⇩

Either way, sorted glass, plastic, metal, and paper is ultimately sold to remanufacturers who make goods with recycled content.

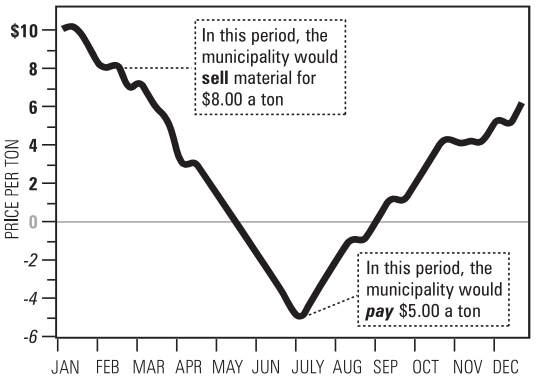
⇩

These are some examples of the products made from residential recyclables. **These products (with the exception of metal) are often of lower grade than the products made from commercial recyclables.**

Positive and Negative Prices

Ideally, municipalities sell recyclables, and processors (MRFs) buy recyclables. Yet when the market value of certain commodities falls to zero, MRFs are not willing to buy these materials.

Under free market conditions, zero-value commodities would simply be disposed of as refuse. But municipalities with recycling laws or mandates can't just do this—they are required to recycle specific materials, no matter what. In such cases, municipalities "sell" these materials for a negative price; in other words, they pay processing firms to take them.



If municipalities are paying, then why is it customary in recycling contracts to use the term "negative price"? There are two reasons. First, different materials in commingled recycling may have positive and negative prices. In that case, the overall per-ton price that municipalities sell recyclables for is the sum of the individual prices for the commingled mix. Second, negative prices fluctuate. Keeping the terminology of prices, rather than talking about paying for service, leaves open the chance for prices to rise to positive numbers when market conditions improve.

Table 1-1
Developed Markets for Secondary Materials

Recyclable material	*Virgin source*	*Developed end uses for recycled material*	*Minor, less developed end uses for recycled material*
PAPER			
Corrugated cardboard 	ground wood pulp	paperboard, linerboard	
Mixed paper 	ground wood pulp	paperboard, linerboard, tissue	insulation, animal bedding
Newspaper 	ground wood pulp	recycled newsprint	board mills, insulation, animal bedding
Office paper 	chemically pulped wood fiber, ground wood fiber	tissue paper, printing and writing paper, paperboard packaging	
METAL			
Aluminum cans/foil 	bauxtite ore	aluminum beverage containers	
Bulk metal 	iron, steel, copper	metal mills, auto industry	
Steel cans 	tinplate steel	steel mills	
PLASTIC			
HDPE bottles 	petroleum derivatives	HDPE bottles	drainage pipe, film, pallets, plastic lumber
PET bottles 	petroleum derivatives	polyester fibers (carpet, clothing)	bottles, strapping
GLASS			
Glass containers 	sand, limestone, soda ash	glass containers	fiberglass, abrasives, aggregate, filler

Note: Established markets for primarily commercial recyclables such as concrete and asphalt are not listed here.

Table 1-2
Undeveloped Markets for Secondary Materials
(MSW components for which weak, unreliable markets exist in some places at some times)

	Virgin source	*End uses*
Food/yard 	organics	finished compost
Milk/aseptic cartons 	paper, polyethylene, aluminum foil	paper, tissue
Non-HDPE or PET plastics 	petroleum derivatives	plastic lumber
Textiles 	cotton, wool, synthetic fibers	bedding and fiberfill
Tires 	rubber, carbon, steel	tire derived fuel, ground rubber

Recycled Materials Prices

Municipalities, recycled-input manufacturers, processors, and brokers constantly monitor, and make decisions based on what is called "secondary materials" commodity pricing.[3] Several trade publications specialize in tracking prices for secondary materials—conducting daily research among the vast network of buyers and sellers in the U.S. and internationally who are engaged in trade (Graphic 1-2). They are standard reference for those in the business, including the City of New York.[4]

Charts 1-1 through 1-4 (pages 21–23) graph the changes in prices for recycled commodities marketed in the New York region over time. While certain materials—white office paper, aluminum cans/foil, natural HDPE plastics, and clear glass—command high prices, other

Graphic 1-2
Published Commodity Prices

Prices for secondary materials can be found in various trade publications.

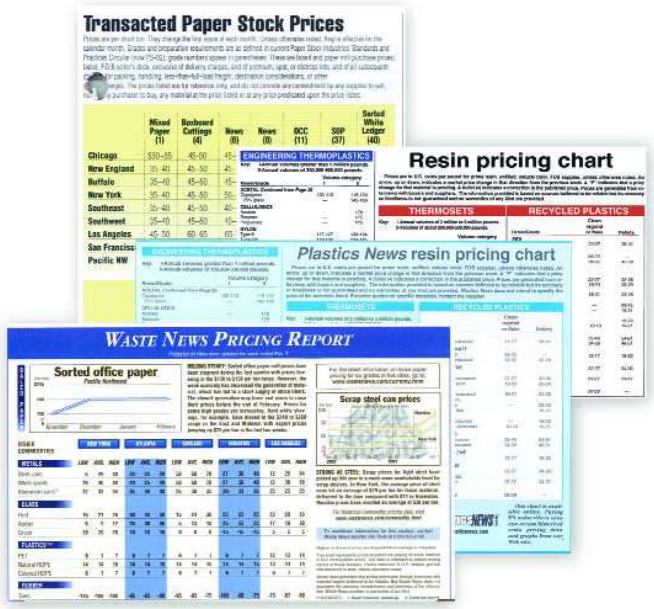
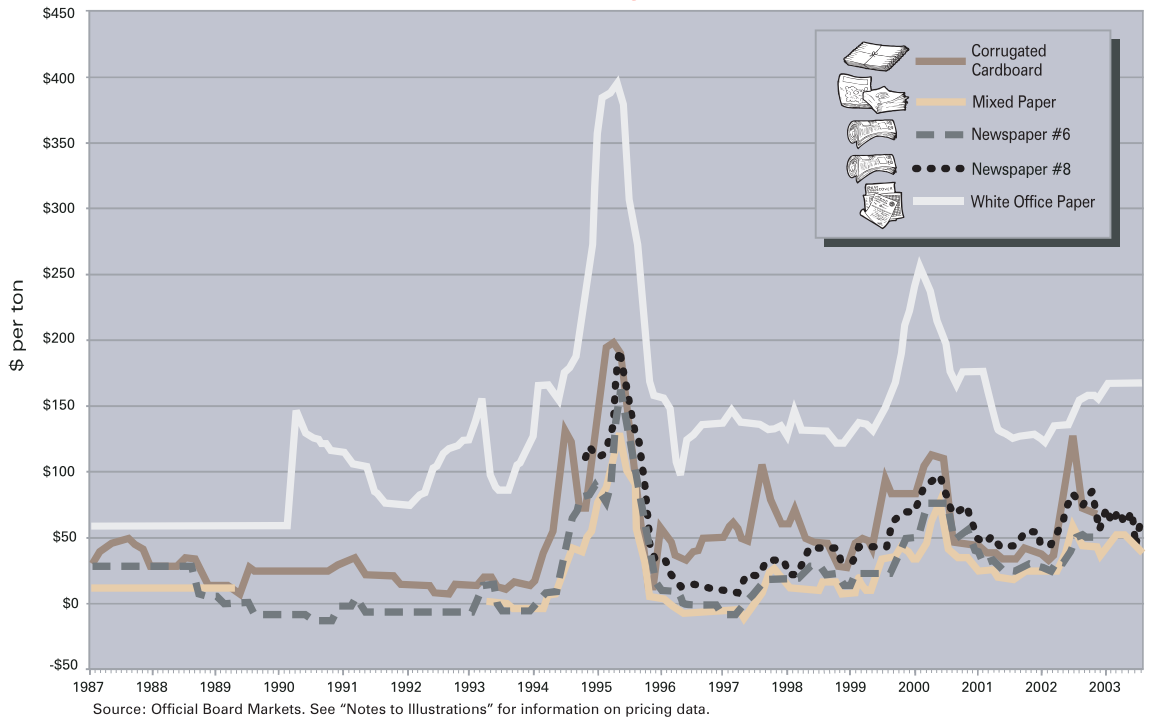
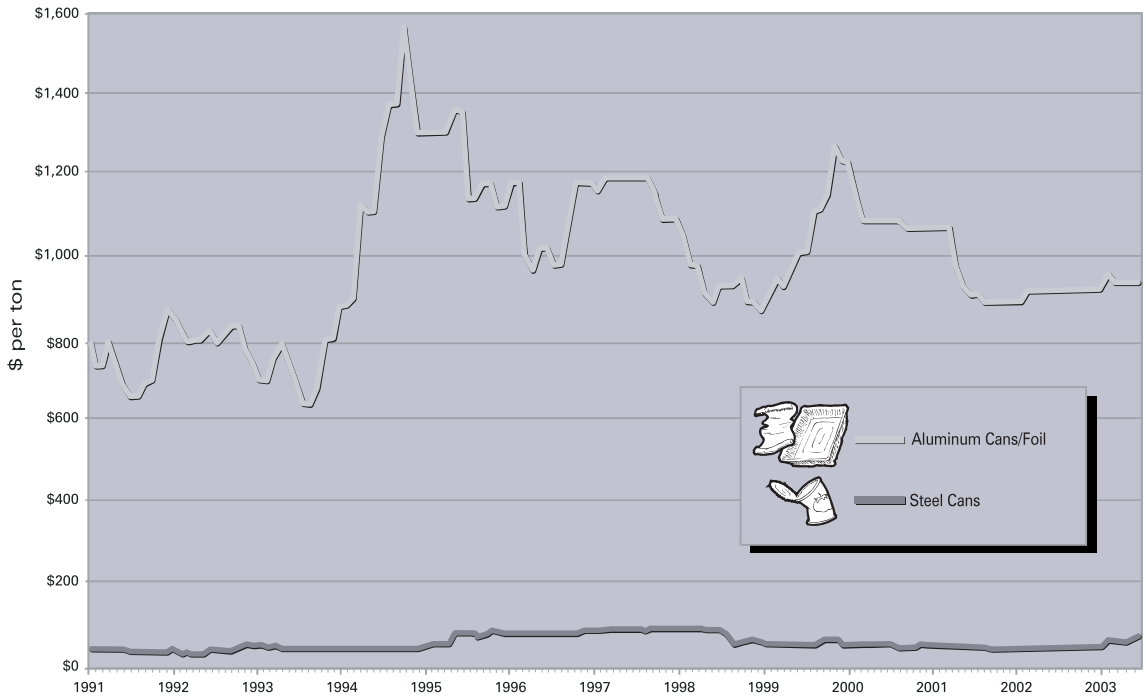


Chart 1-1
Recycled Paper Prices
New York Region



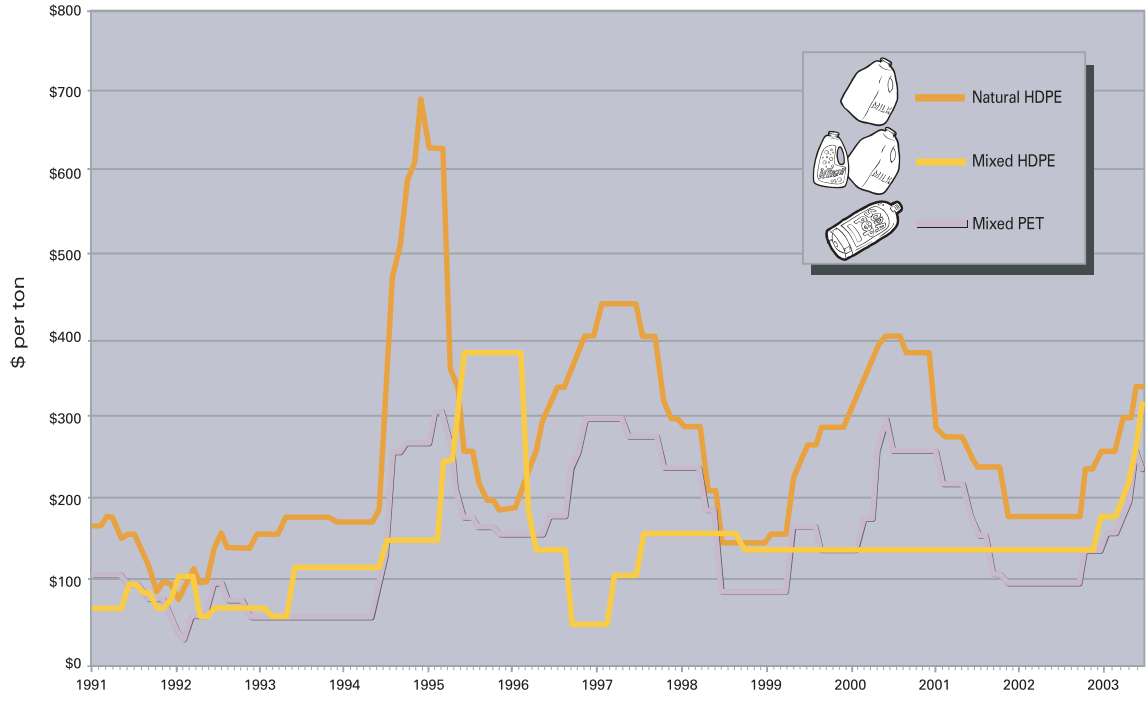
Source: Official Board Markets. See "Notes to Illustrations" for information on pricing data.

Chart 1-2
Recycled Metal Prices
New York Region

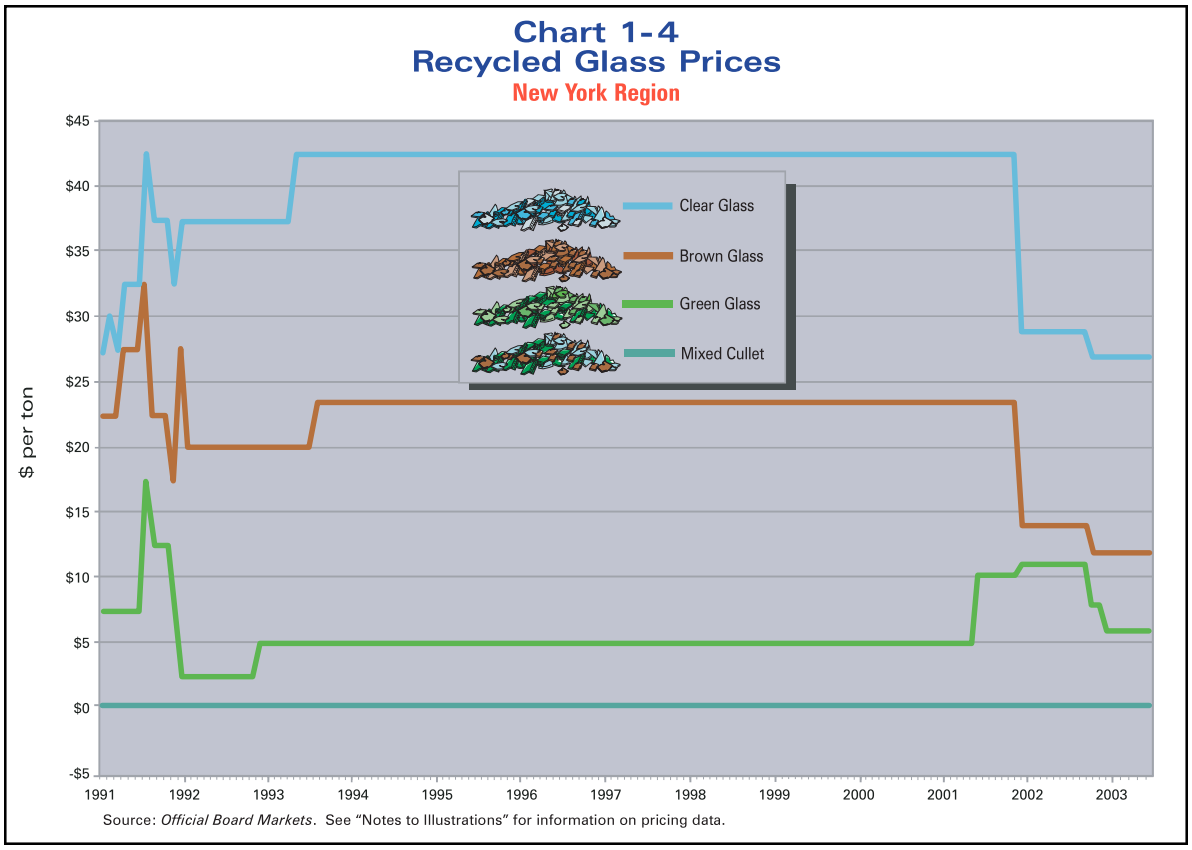


Source: *Recycling Manager*. See "Notes to Illustrations" for information on pricing data.

Chart 1-3
Recycled HDPE and PET Plastic Prices
New York Region



Source: *Recycling Manager*. See "Notes to Illustrations" for information on pricing data.



materials normally collected in municipal recycling programs—mixed paper, steel cans, and mixed glass—are worth much less. With the exception of glass, all the commodities represented in the charts show a great deal of market volatility.

Why are these markets so volatile? And why are some materials so much more valuable than others? The answers lie in the fact that after recyclables are collected, they enter a highly competitive materials economy that starts locally, and very quickly goes global.

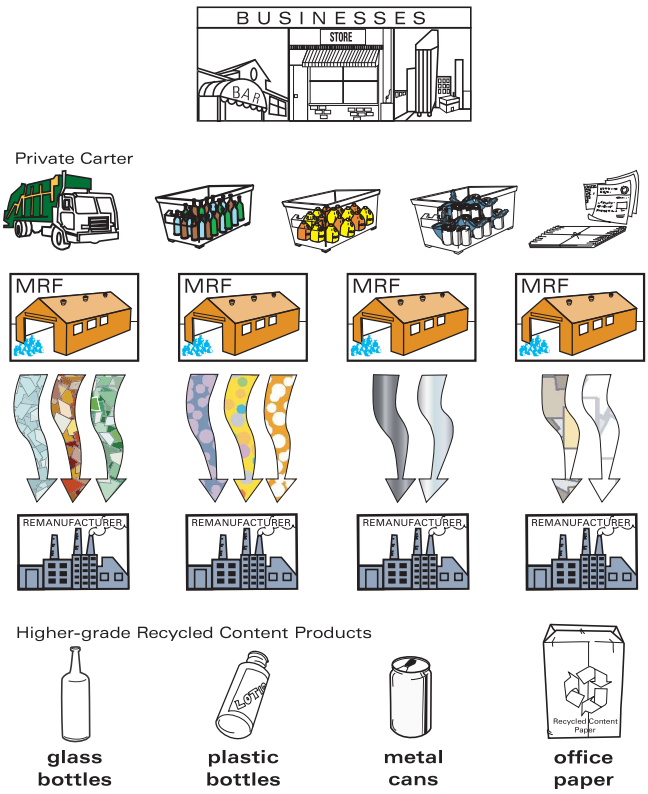
Competition Between Various Buyers and Sellers

Charts 1-1 through1-4 show prices for post-consumer recyclables—but even these volatile prices don't reflect the extent of price instability among recyclables culled from different sources of municipal solid waste (MSW). This instability reflects the fact that within the secondary recyclables market, competition is occurring all the time, among a variety of buyers and sellers.

Commercial vs. Residential Recyclables

The term MSW refers to waste generated in human settlements—rather than by industry, agriculture, or other large-scale production operations. Residents account for a little over half of all MSW. The balance is generated by commercial sources, such as offices, restaurants, and other businesses. Recycling from these municipal commercial sources also enters a city's recycling economy (Figure 1-2, page 24).

Figure 1-2
Buyers and Sellers in the Market for Commercial Recyclables



Commercial Recycling comes from **businesses**, including bars, restaurants, stores, and offices. These sources **sell** recyclables to the private carters who collect their waste. Sale takes place either directly or by receiving a reduced fee for refuse hauling.

⇩

Private carters in turn **sell** commercial recyclables to **materials recovery facilities** (MRFs). Sometimes, these same MRFs buy municipal recyclables. Other times, they specialize in processing materials from commercial sources only.

⇩

Because commercial recycling is typically "cleaner" (more homogeneous) than municipal recycling, it has a competitive edge. Color-sorted glass, for example, may not need secondary processing.

⇩

Processed commercial recyclables are sold to **manufacturers** of recycled-content products. Some of these manufacturers buy only commercial recycling; others buy both residential and commercial.

⇩

Processed commercial recyclables are typically used to make higher grade products than processed municipal recyclables.

Commercial recycling is typically collected by private companies (carters), who have contracts with businesses to haul away their waste. In New York City, regulations require businesses to make arrangements with carters for the recovery of designated paper materials, and, in the case of food and beverage establishments, certain kinds of metal, glass, and plastic.[5]

The carters in turn sell these commercial materials to processors, manufacturers, and brokers—often the same ones that accept a municipality's residential recycling. But since businesses tend to generate cleaner and more homogeneous recycling than households, processors frequently prefer to receive material coming from commercial sources. Whether they are bars turning over inventories of bottled beer, offices generating scrap paper, or grocery stores discarding boxes—commercial establishments by their very nature generate higher quality recyclables more consistently than do residents (Photo 1-2). For this reason, the commercial stream of recyclables is more desirable to processors and they will pay more for commercial material. In this competitive scenario, municipalities, which specialize in collecting residential recyclables, lose out.

This in turn can lead to competition among processors located within the same area, who sell their sorted, baled materials to manufacturers on a local market. For instance, if a decorative-tile factory seeks green glass to make its product, and looks around for a local supply source, it may choose to buy recycled glass from a processor that only takes bottles from bars and restaurants, rather than an MRF that handles commingled residential materials (Photo 1-3).

Photo 1-2

Hundreds of commercial carters (top left) provide recycling collection service to thousands of New York City businesses each day. Businesses typically generate cleaner streams of recyclables, as shown in an office building's paper recycling (mostly boxes and white paper—top right) and its commingled container recycling (nearly all water bottles—bottom left). In contrast, residential streams contain a greater mix of materials. Bottom right photo shows residential paper recycling at one of DSNY's processors.

Photo 1-3

Sorted green bottles from a local bar (left). The quality of commercial glass contrasts sharply with what residential glass (right) looks like after it is separated at an MRF from commingled metal, glass, and plastic recyclables.

Another source of competition for processed recyclables is the industrial scrap that manufacturers generate (Photo 1-4). This leftover paper, metal, and plastic from the production process is almost always higher in quality than processed recyclables, and so is often preferred by manufacturers—even over post-consumer commercial recycling.

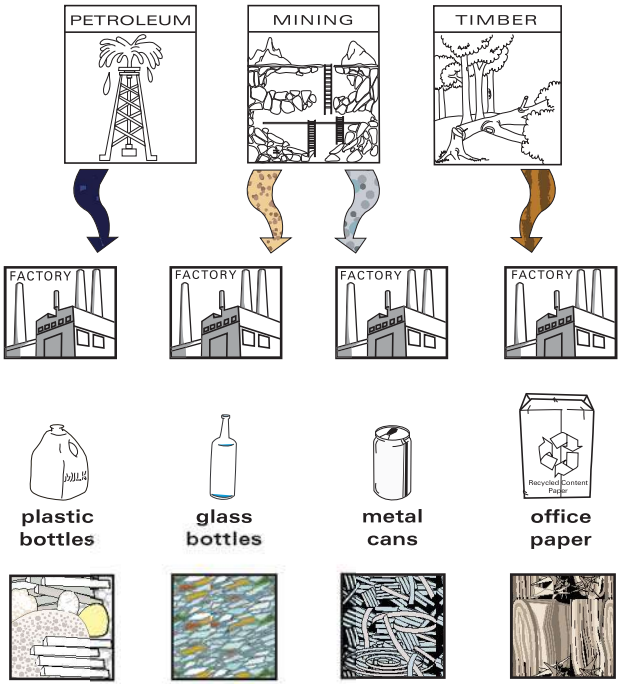
Secondary vs. Primary Materials

Depending on what is being manufactured, sellers of secondary materials also compete with the wide array of businesses engaged in production using virgin materials (Figure 1-3). Virgin prices fluctuate according to the availability of mined, harvested, or extracted resources that are traded globally every day. While they are typically more expensive than secondary materials on a ton-for-ton basis, their superior quality may make them more economical to use. And there are even cases where virgin prices fall to, or below, secondary prices—as surprising as that may sound.

Photo 1-4

Because of its higher quality, manufacturers prefer to use industrial metal and plastic scrap (shown in these pictures) as inputs for their production processes, rather than processed recyclables.

Figure 1-3
Primary Materials Industry as Sources of Competition for Recycling Markets



Most consumer products are made from virgin materials that originally came from **raw materials industries**, such as petroleum, mining, and timber. Petroleum byproducts are used to manufacture plastics. Mining supplies the silica sand to create glass and the metal ore to produce metal products. The pulp to make paper comes from the timber industry.

⇩

Once raw materials are processed, they are **sold to primary (or virgin) manufacturers** who produce products that may be different from, similar to, or the same as products manufactured with recycled content.

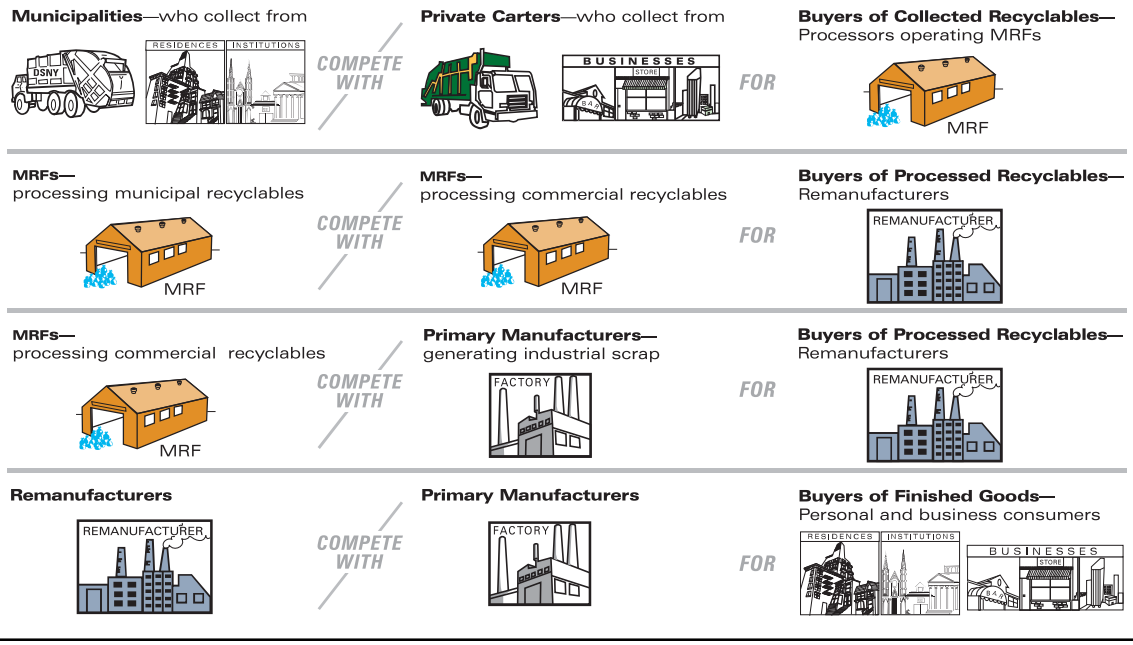
⇩

Virgin products sold to consumers often compete with recycled-content products.

⇩

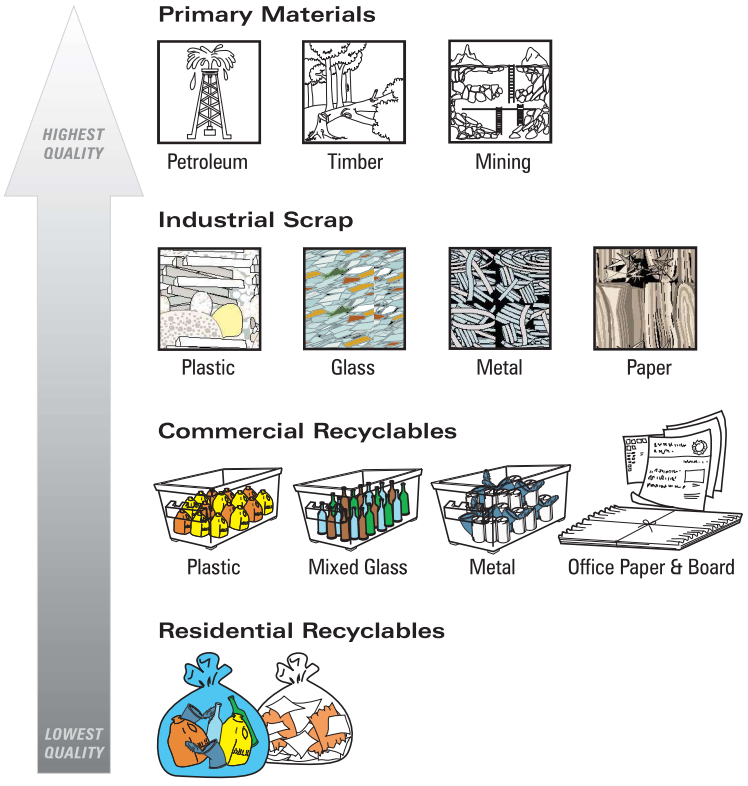
Primary manufacturers also **sell** "industrial scrap," the left-over plastic, glass, metal, and paper from the production process. Industrial scrap is almost always higher in quality than commercial recyclables, and far superior in purity than residential recyclables.

Figure 1-4
Summary of Competition Among Buyers and Sellers



Figures 1-4 and 1-5 summarize how the various buyers and sellers in the recycling market place compete with one another. Due to the lower quality of residential recyclables (compared to commercial recyclables, industrial scrap, or virgin materials), municipalities are in the weakest position. In other words, the recycling that people set out at home, and which the Sanitation Department collects, has a very tough time getting a good price on the market, given the other recyclable materials available for sale. This makes running a residential recycling program more costly, and less stable, than managing a commercial/industrial recycling operation.

Figure 1-5
Quality of Recyclables
in terms of cleanliness, consistency, and suitability for use as an input to production



How Recycling Competes with Disposal

Competition exists not only among recycled and virgin commodity processors and manufacturers, but also from a strong, third rival: waste disposal (Photo 1-5).

If recyclables are commodities which are **sold**, while disposal of refuse at landfills and incinerators costs **money**, then how can it be that recycling competes with disposal? Recycling competes with disposal under two scenarios:

1. On the Municipal Level: Competition via the Local Law

Local laws determine what is "recycling" and what is "refuse" for each municipality. These laws reflect an understanding of the total costs for recycling as the sum of program administration, collection, transport, and processing, plus the sale price for recyclables. Total costs for refuse include program administration, collection, transport, and disposal.

Photo 1-5

Despite the strength of recycling programs, in 2000 around 70 percent of MSW was disposed of in landfills or incinerators.[6]

Total Costs, Per Ton

Recycling	*Refuse*
–Administration	–Administration
–Collection	–Collection
–Transport	–Transport
–Processing	–Disposal
+Revenues from Sale of Recyclables	
TOTAL	TOTAL

Because of economies of scale, collection and transport of refuse usually cost less per ton than collection of recyclables. Administration for recycling programs (due to education and outreach expenses) usually costs more. On the other hand, the sale price for valuable commodities is a revenue, not a cost. This is clearly preferable to the cost of disposing of valuable commodities.

Nonetheless, disposal may still be less expensive than recycling *in total.* This is especially true when commodities have a *negative sale price* (see Figure 1-1), which means that municipalities must pay to have them recycled. For this reason, local recycling laws typically designate materials with positive sale prices, or the potential for positive sale prices, as recyclable.

When disposal costs are low, there is more incentive for laws to count low-value materials as refuse than recycling. Of course, municipalities may still choose to designate low-value materials for environmental reasons, but in those cases it is understood that a greater taxpayer expense will be involved. In this way, recycling and disposal compete economically when local recycling laws are considered and implemented.

2. On the Commercial Level: Competition via the Free Market

Some localities (like New York) also require commercial recycling of high-value commodities via local laws. Many others do not. In purely free-market situations, businesses, or the hauling firms they contract with, will calculate total costs for collection and transport, and weigh them against the sale price of materials for recycling, or the cost of landfilling. In these situations, what ends up as refuse and what is recycled may

change as market conditions change. Here, recycling and disposal are competing economically as part of normal business decisions, with businesses constantly seeking to minimize total waste-management costs.

Consolidation of the Waste-Management Industry

In the United States, a highly consolidated waste disposal-industry competes with recycling for materials and profits—but this competition is far from the free and equal sort envisioned by Adam Smith in his *Wealth of Nations.*[7] A vast number of small recycling businesses—including independent MRFs, recycled commodities brokers, foreign importers, and recycled-content manufacturers confront a waste-management industry dominated by two, large, multinational corporations (Figure 1-6).

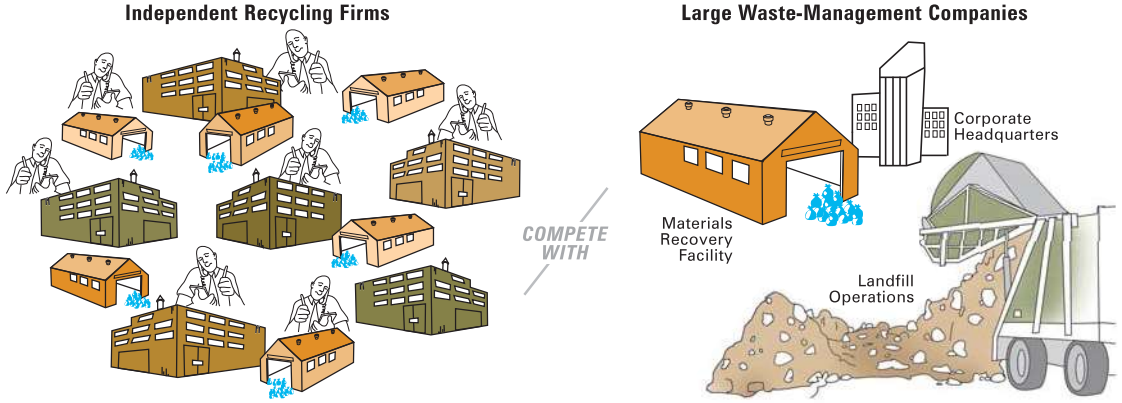
These multinational "waste giants" own numerous landfills across the county, have extremely well-developed transportation networks, and hold disposal contracts with many municipalities. Moreover, they occupy an interesting dual position. On one hand, they clearly consider recycling as a competitor to disposal; on the other, many of these same companies provide recycling services as part of their overall waste management contracts. As reported by Dow Jones:

> Recycling has been a modest money-losing venture for publicly traded solid waste companies such as Waste Management and Allied Waste industries. It is a relatively small part of the companies' revenue (less than 6%)…but it's a significant service because municipalities demand it. Low prices for recycled commodities, however, have hurt companies' bottom lines for the last several quarters.[8]

Another investor news source explains this paradox even more bluntly:

> Although publicly traded waste companies derive a very small portion of their revenues from it, recycling is primarily seen as a competitive threat because it steals volumes away from landfills, their most promising assets. Therefore, we view any declines in recycling as bullish for these stocks.[9]

Figure 1-6
Competition Between Recycling and Waste Disposal



- Intense competition among **many independent recycling firms** stimulates technological development in the area of materials recovery.
- Recycling generates profit for these firms, but disposal of residue is pure cost.
- Recycling is therefore maximized, and disposal minimized.
- **The overall result is *more* and better recycling.**

- The large size and small number of **consolidated waste-management corporations** means less competitive pressure for technological development in the area of materials recovery.
- Both recycling and disposal generate profit for the same parent company, so materials are sent to the less expensive option, which is usually landfilling.
- **The result is *less* recycling, and more disposal.**

A June 2001 article in the industry journal *MSW Management* discussed the implications of such competition between recycling and landfilling, observing that:

> …if consolidators [i.e., large waste management companies] control all of the MRFs in a region, they have the opportunity to increase prices [for processing] above market rates, making recycling look less attractive than it would with true competition.…Do the facts on the ground bear this out? In the last decade, the consolidators' involvement in MRF processing on a weight-adjusted basis has grown from a third to more than half….
>
> [One such company] replies that it serves the needs of its customers and, if its customers want recycling, that is what the company will happily provide. There is an element of truth in this, and that ought to be acknowledged. But what that defense misses is the key difference between continuing the programs that now exist and expanding them to the next level….In much of the U.S., local recycling programs are beginning to report slow deterioration in their recovery fractions.…There's little incentive for recyclers of any stripe to diverge into new programs.[10]

World Markets

Despite the fierce competition and volatility in secondary materials markets, the trade in materials that were once "somebody's" waste is thriving. One of the reasons for this is the fact that one country's discards are another's resource. In fact, the United States is one of the world's largest exporters of recycled materials. Where does it all go?

Canada is a large and steady importer of U.S. newsprint, but Asia makes up the most dynamic and arguably the most important foreign market for U.S. recycled materials overall. China, Japan, South Korea, and Taiwan are low on forest resources, and consequently depend on wastepaper imports for production. At the same time, these countries are rapidly modernizing, and possess a great deal of pent-up demand for materials as their production systems mature.

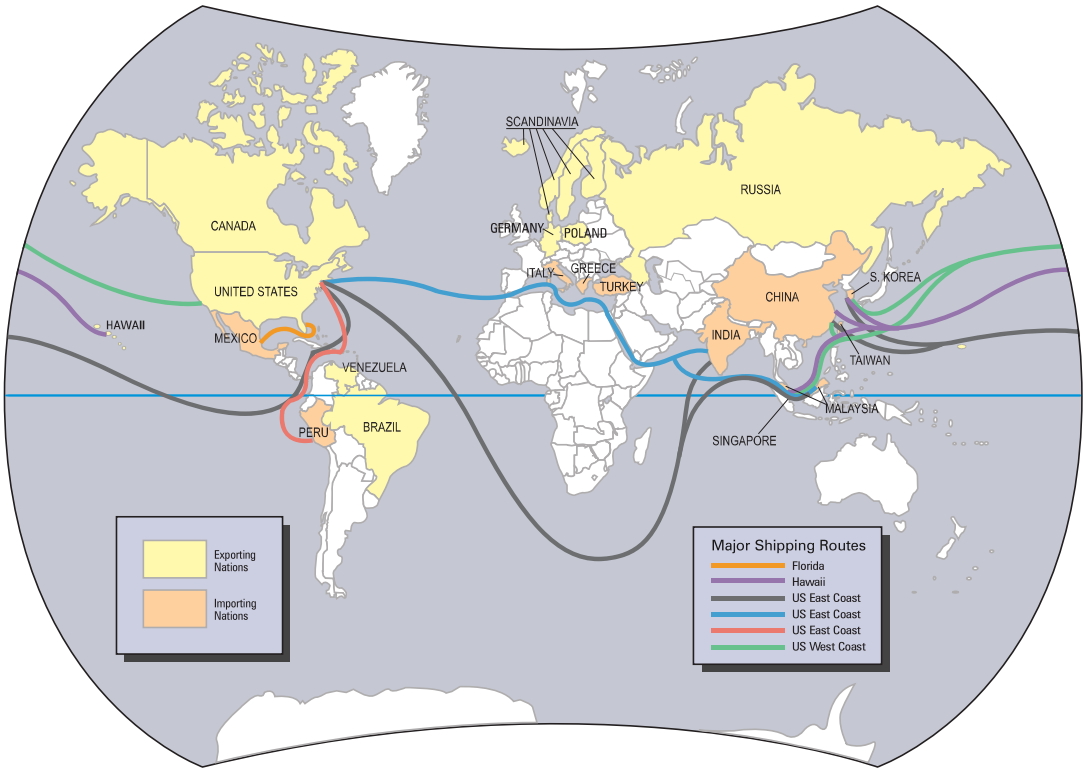
Developing countries in Asia have lower labor and operating costs for processing waste materials, different manufacturing-quality standards, and sometimes looser environmental regulations than do Western industrialized nations. U.S. discards, therefore, represent an essential resource for such economies. In fact, the California Integrated Waste Management Board (CIWMB) observes that "the most important force driving the value of many secondary foreign markets is their importance as primary sources of feedstocks for industrial operations."[11]

The United States' role as a major exporter of recycled materials has been essential to the growth of the recycling industry in this country, and has been crucial in the establishment of regional and national markets at home. However, our dependence on export to sustain robust markets has its downside as well. The U.S. must compete as an exporter with Europe, whose high levels of affluence, strong environmental regulations, and well-established municipal recycling programs make it a formidable opponent—especially among markets on the east coast (Figure 1-7).

As a result, the U.S. recycled-materials markets ride highs and lows that are closely related to economic conditions in other countries and our nation's overall balance of foreign trade. Factors such as currency exchange rates, commodity stockpiling by foreign buyers, and the availability of technology lead to periods in which the U.S. finds it more or less difficult to export its surplus recycled materials to other countries.

Figure 1-7
Markets for U.S. Exports of Recyclables

East and west coasts of the United States compete with Canada, as well as with exporting nations in northern Europe and South America, for markets in Asia, southern Europe, and Latin America.



One interesting variable affecting overseas trade in recycled materials is the availability of cargo-shipping containers at any given time (Photo 1-6). When the U.S. economy is strong, there are more imports of goods from abroad. Exporting recycled materials becomes very cost-effective if these same containers can be used to send recovered materials back. When the U.S. economy slows down, shortages of these containers lead to an oversupply of recycled materials at home. Prices for these materials then fall.

Unlike most commodities, the supply of residential recyclables cannot be controlled in response to fluctuations in demand—people put their paper, metal, glass, and plastic out every day, no matter what the economy is doing. Slower economic periods mean "downtime" for factories, due to reduced demand for finished products. When this happens, the whole manufacturing system backs up. Recycled materials accumulate in stockpiles, which results in lower prices when the economy gets going again.

Photo 1-6

In good economic times, there are stockpiles of cargo-shipping containers due to the import of goods from abroad. Exporting recycled materials becomes very cost-effective if these same containers can be used to export recovered recyclables.

Regional Factors

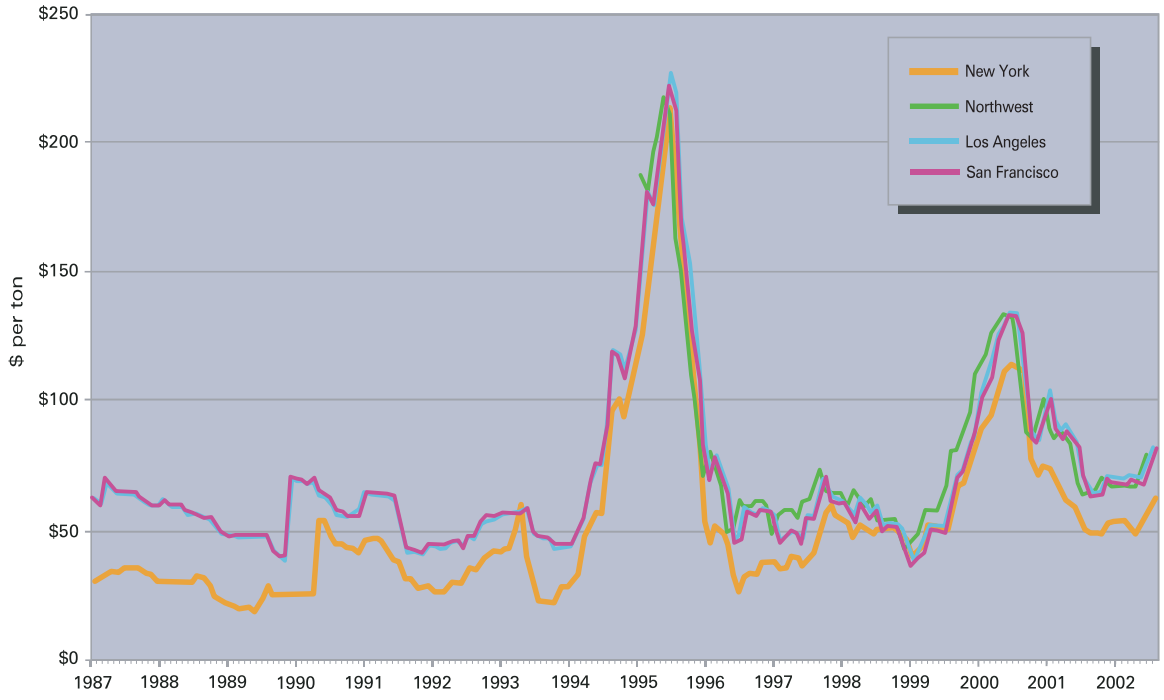
Although states throughout the U.S. have equal access to land-based trade in recycled materials with Canada, west coast states—notably California, Oregon, and Washington, benefit from access to ports heavily engaged in Asian trade (Figure 1-7). East coast states, whose natural market is Europe, lack this advantage due to northern Europe's status as a recycled-material exporter, not importer.

Charts 1-5 and 1-6 show differences in market prices over time for paper and MGP respectively for the New York region compared with west coast regions. While New York follows the same price fluctuations as the west coast, prices for recycled materials in the New York region are consistently lower.

Less densely developed areas of the U.S. (the west, midwest, and south) also compete with the congested regions of the northeast in terms of transportation and storage costs, giving them an advantage over the northeast. In fact, northeastern prices for paper, green glass, and HDPE have consistently come in lower than other regions for the past twenty years.

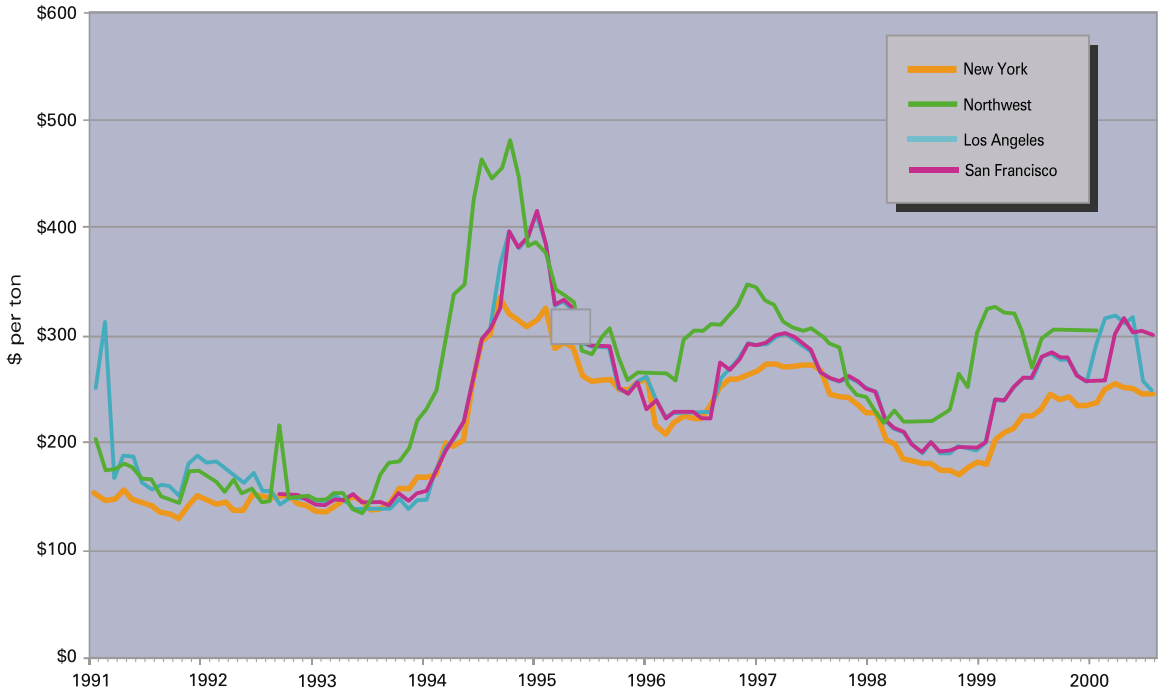
State-level legislation, particularly recycled-content requirements, also contributes to regional market differences. State-sponsored, recycled-content requirements, which force producers of certain products in a state to utilize recycled materials in their production processes, builds demand for secondary materials locally. California is one of nine states to impose minimum recycled-content requirements for manufacturers of certain kinds of plastic, glass, or paper products. Its large size and particularly comprehensive laws, combined with the advantage it enjoys from access to Asian exports, make markets in this state remarkably robust.

Chart 1-5
Comparison of Paper Prices in New York Region to West Coast Regions
Average of Mixed Paper, Newspaper #6, Newspaper #8, Corrugated Cardboard, and White Office Paper



Source: *Official Board Markets*. See "Notes to Illustrations" for information on pricing data.

Chart 1-6
Comparison of MGP Prices in New York Region to West Coast Regions
Average of Steel Cans, Aluminum Cans, Natural HDPE, Mixed HDPE, Mixed PET, Clear Glass, Green Glass, and Brown Glass



Source: *Recycling Manager*. See "Notes to Illustrations" for information on pricing data.

Other government initiatives—including deposit legislation, environmentally preferable purchasing, and economic development policies—are widely held to be beneficial in strengthening recycling markets and recycling rates. These, as well as other government initiatives, are discussed in more detail in the next section.

Government Intervention into Markets

In the United States, government intervention into free-market activity usually must be justified. Even if the opposition of affected businesses can be overcome, it is politically unwise for government to intervene unless there is a real and demonstrated social need that unregulated markets are clearly failing to meet. In the case of recycling, this need is—stated broadly—environmental and public health protection, as well as the avoidance of the cost and nuisance of refuse disposal.

A host of federal and state laws, including the federal Resource Conservation and Recovery Act (RCRA), set guidelines for waste transport and disposal, controlling their environmental impacts. These landmark laws, enacted in the 1970s and early 1980s, represent the most direct form of government intervention into waste management. Since they were put into place, landfill and other disposal costs have increased dramatically, giving recycling an edge. In fact, the early success of recycling can be attributed to the sudden jump in landfill fees brought on by strict environmental controls like RCRA and its state-level equivalents.

Government intervention since then has taken a different form, however. Federal, state, and local governments have endeavored to strengthen recycled-materials markets through a number of legislative mechanisms that

aim to increase the flow of recycled materials through the marketplace and/or spur demand for such materials. These include:

- Recycling mandates
- Container deposits (Bottle Bills)
- Government procurement mandates
- Recycled-content requirements

Each of these legislative actions is designed to make recycling more competitive in the materials economy. On this topic, there is a great deal of literature in the field of environmental planning and management that describes *how* such policies are supposed to work, presents case studies of successful implementation, and demonstrates how the recycling sector has, as these policies have been implemented over the 1990s, grown prodigiously.[12] There is, however, much less in the way of evaluation of such policies' overall impact on prices or markets, especially against larger economic forces that create volatility. There is not much research on the role of scale in policy implementation either. Programs enacted at the state level, for instance, may generate secondary effects that interfere with the success of municipal recycling programs. A full discussion of these issues as they pertain to each policy initiative follows.

Recycling Mandates and Goals

At the federal, state, and local level, the use of recycling mandates or goals is widespread. In 2000, President Clinton issued a nationwide recycling goal of 25 percent[13] which, by many accounts, appears to have been attained on average.[14] Most states set mandatory or voluntary recycling rates (as shown in Table AI-1 in Appendix I), as do many counties and localities. New York City, for instance, imposed what was in effect a 25 percent recycling mandate in 1989 at the inception of its curbside program.

The obvious purpose of recycling mandates or goals is to set priorities for public agencies, and hold them accountable for implementing successful programs. Mandates and goals set benchmarks against which agency performance can be evaluated, and if necessary, improved. In a few states, producers of certain products also fall under mandates. The state of California, for instance, requires manufacturers of plastic and glass containers and newsprint to maintain certain recycling rates statewide for their products or face additional regulatory burdens.

The point of recycling mandates and goals is to increase diversion of materials from disposal. For municipalities, greater rates of recycling improve collection productivity, as trucks need to drive shorter distances before they fill up. By increasing the recycling rate, states and municipalities also hope to save money by avoiding disposal costs and generating revenues from the sale of what is collected. If increased supply actually stimulates demand, this may eventually lead to a growth in local or statewide processing capacity and recycled-manufacturing industries.

This is, at least, how it is supposed to work. But as real market conditions in the U.S. have shown, increases in supply often depress prices. When this occurs, revenues to municipalities fall and disposal becomes a more cost-competitive alternative. In the long-run, "hanging in there" with sustained, high recycling rates does indeed lead to development of processing capacity. This puts cities in a good position for an eventual rebound in markets. The question is then how long municipalities can afford to wait out such periods. Doing so requires a strong commitment at the local and state level to maintaining funding for municipal programs even when they "appear" to be losing money.

Container Deposits (Bottle Bills)

Eleven states—California, Connecticut, Hawaii, Iowa, Maine, Maryland, Massachusetts, Michigan, New York, Oregon, and Vermont—currently sponsor legislation that requires beverage container manufacturers and/or distributors to charge a deposit on the bottles and cans they sell (Photo 1-7). Residents pay a surcharge to retailers at the point of purchase, redeemable by returning intact empties. Distributors are in turn required to collect and transport empty containers, taking responsibility for them from there. Bottle Bills are highly efficient and impose few costs on public agencies. Combined, they account for between 5 and 15 percent of total materials recovery in the states they cover.[15]

As opposed to curbside collection, Bottle Bill redemption yields a relatively clean and well-sorted stream of aluminum cans and PET bottles, as well as color-sorted glass containers that drastically reduces processing costs and improves the marketability of what is recovered (Photo 1-8). For this reason, they are hailed as one of recycling's great success stories.

Most states, including New York, allow distributors to keep unredeemed deposits. Amounts can be sizeable and represent a windfall for producers. California's deposit system stands in stark contrast to other examples in this regard. There, the state government, and not the retailers, administers redemption and retains unclaimed deposits, which are used to fund local waste-management programs. Revenues lost from curbside aluminum recycling are thus redistributed, while the State directs redeemed containers towards recycling.

Government Procurement Mandates

In the United States, consumers—whether individuals or businesses—can only be encouraged, not required, to alter their purchasing decisions. A variety of economic incentives, including taxes and subsidies that are passed on to the consumer, use the price mechanism to steer purchasing in one way or another. But the state cannot command private consumers to buy more or less of a good. This would interfere with the freedoms of choice and expression that are the cornerstones of American democracy.

Photo 1-7

These soda bottles are redeemable in New York and Connecticut for five cents each.

Photo 1-8

Bottles and cans are sorted and compacted during the redemption process. The result is a far cleaner stream than curbside collection.

The government sector, in contrast, represents one area in which large-scale purchasing *can* be directly affected by public policy. The EPA's Comprehensive Procurement Guidelines, imposed in 1995 and strengthened several times since then, are designed to orient the vast purchasing power of federal agencies towards recycled products. While neither the EPA nor other federal agencies are authorized to enforce these guidelines, some provisions exist for its evaluation and oversight when the EPA conducts federal facility inspections.

Many states and localities impose their own environmentally preferable procurement policies. Typically, they require government agencies to purchase recycled-content, low-energy, or other environmentally preferable goods—provided the products meet certain standards and agency performance is not undermined. The purpose of procurement mandates and guidelines is to stimulate demand for recycled materials both directly—through the market mechanism of purchasing—and indirectly by encouraging new recycled-content manufacturers.

What are the impacts of such policies? Few if any evaluations of the direct relation between government purchasing practices and market prices exist. It is likely that the recycled office paper industry—for which substantial capacity already exists and which represents a major budget item for public agencies—has benefitted from such programs. For other markets, it is simply too early to evaluate the impact, and it remains possible that government purchases—while potentially vast in scope—are still too small to affect markets in the face of global and domestic forces.

NYC Local Law 19: Purchase of Recycled Products

Chapter 3 of Local Law 19, originally enacted in 1989, is also known as the New York City Recycling Law. The law establishes the *"policy of the city to promote the recovery of materials from the New York City solid waste stream for the purpose of recycling such materials and returning them to the economy."* Subchapter 5 addresses the City Purchase of Recycled Products.

DSNY promotes this aspect of Local Law 19, as well as encouraging other forms of Environmentally Preferable Purchasing, on its NYCWasteLe$$ website: www.nycwasteless.org.

At the municipal level, instituting environmentally preferable procurement policies may (or may not) save agencies money, but may also provide a powerful symbolic support for the local recycling effort and recycling in general. At the same time, such policies are not likely to affect the success or failure of that municipality's recycling program without comprehensive coordination of production and consumption at a local and even regional level. In other words, there has to be a robust infrastructure of plants able to use a municipality's recycled inputs, and then to produce goods that the municipality's government can actually use. Such a "closed loop" urban vision is immensely appealing but has yet to be realized in any large-scale, sustained manner in the United States. What is far more likely, and what has indeed occurred, is that municipal recyclables enter a much larger and complex market that spans domestic and international markets.

Recycled-content Requirements

One method that has been successfully used to close the loop at the state level is recycled-content manufacturing laws. Such arrangements typically require or encourage producers of a certain good to use a set

minimum percentage of recycled feedstock in products made, distributed, and in some cases just sold, in that state. Table 1-3 summarizes the states (or district) that currently have recycled-content laws and the products that these laws cover.

Table 1-3
Recycled-Content Laws

State/District	*Product*	*Content*	*Goal Date*
Arizona	newsprint	20%	2000
California	fiberglass insulation	30%	1995
	plastic trash bags	30%	1995
	rigid plastic packaging containers	25%	1995
	glass containers	35%	1996
	newsprint	20%	2000
Connecticut	newsprint	45%	1999
	telephone books	35%	2001
Illinois	newsprint	28%	1993
Maryland	newsprint	35%	2003–4
	telephone directories	35%	2003–4
Missouri	newsprint	50%	2000
Oregon	rigid-plastic packaging containers	25%	1995
	telephone books	25%	1995
	glass containers	50%	2002
	newsprint	7.5%	1995
Washington, D.C.	high-grade paper	50%	1994
	tissue	5–40%	1994
	unbleached packaging	5–35%	1994
	newsprint	40%	1998
Wisconsin	rigid-plastic packaging containers	10%	1995
	newsprint	40%	2003

Source: Grassroots Recycling Network. *Wasting and Recycling in the United States 2000* (ISLR: Washington, D.C., 2000).

Mandatory recycled-content provisions are most prevalent in the case of newsprint. The states of Arizona, California, Connecticut, the District of Columbia, Illinois, Oregon, Maryland, Missouri, and Wisconsin have goals or requirements for newsprint production that range between 7.5 to 50 percent.

Less common are regulations targeting plastic, glass, and other materials. The states of Oregon, Wisconsin, and California mandate minimum-recycled content in rigid-plastic packaging containers (RPPCs). Typically these laws target beverage and non-food vessels, exempting products containing substances regulated by the Food and Drug Administration. Wisconsin's law requires a 10-percent-recycled content in such packaging, although it allows the counting of pre-consumer scrap toward this requirement. In Oregon, if the annual, state recycling rate for RPPCs falls below 25 percent, individual manufacturers must demonstrate this level of recycled post-consumer content in their products. Alternately, they may show that their product is consistently reused a minimum of five times, or that it is by itself recycled at a rate that exceeds 25 percent.

A similar, but more comprehensive, law applies in California, which a recent review of recycled-content mandates dubbed as having "the most complicated RPPC law and…the only state to have taken enforcement action."[16] The California Integrated Waste Management Board (CIWMB) monitors and enforces content regulations using a combination of periodic waste-characterization data, manufacturer reporting requirements, and sales-data analysis. The laws apply to all "product manufacturers" in the state, including distributors and importers. According to the CIWMB: "A company must comply…if it manufactures, distributes, or imports a product that is packaged in an RPPC and is sold or offered for sale in CA, and if its company name is on the container label."[17]

Like Oregon, if the CIWMB determines that the statewide recycling rate for RPPCs is above 25 percent, all companies are deemed in compliance—with the exception of PET rigid containers, which must reach a recycling rate of 55 percent. Otherwise, manufacturers must show at least a 25-percent post-consumer content or five-plus times refill use. California also offers the option of light weighting products by 10 percent in place of content requirements.

California is also unique in the nation in applying similar requirements for glass product manufacture. The CIWMB writes that, "The demand for cullet in California is driven primarily by the production rates of California's glass food and beverage container and fiberglass manufacturing industries and the State's minimum content requirements for (glass) food and beverage containers and fiberglass."[18] By law, fiberglass producers have to use at least 30 percent post-consumer cullet for insulation made or sold in California, and manufacturers of glass food and drink containers must use at least 35 percent. The state applies similar content requirements to plastic trash bags as well.

California stands alone in its integration of recycled-content requirements with state agency procurement mandates. The state's Public Contract code requires all product suppliers to certify the recycled content of products offered or sold to the government. The State Agency Buy Recycled mandate in turn requires agencies to purchase recycled-content products representing at least 50 percent of dollars spent on products within ten product categories. These include printing and writing products, paper products, compost, glass products, lubricating oils, paint, solvents, tires, tire-derived products, steel products, and plastic products (including toner cartridges, diskettes, carpet, office products, hoses, and other uses besides containers). This linking of recycled-content mandates with government procurement requirements represents a rare case of a geographically "closed loop" materials economy, albeit at the level of the state and not the municipality.

In California, as elsewhere, manufacturers have in some cases attempted to evade the law by altering container and product characteristics so as to be excluded from regulation (for example, switching from rigid to flexible containers), and have also complained about the impact of content requirements on product quality. An alternative typically preferred by industry is the *voluntary* recycled-content agreement, which may be facilitated at the state level or nationwide within a certain industry or corporation. An example of a state-organized voluntary approach can be seen in New York, where a 1989 accord among the top eleven newsprint producers in the state led to increases in post-consumer recycled content in this product, and has, according to the NYS DEC, resulted in significant investment in recycled newsprint de-inking capacity nationwide.[19] It should be noted, however, that there are still no recycled-newsprint mills located in New York State. As is often the case in the absence of mandates, the economic opportunities afforded are at a national, rather than a state or local, scale.

A number of major manufacturers have made voluntary commitments to manufacture their products using post-consumer recycled content. The Coca-Cola company, for instance, pledged in 1990 to aim for a 25-percent recycled content for its bottles produced in North America, although as of yet it has attained only 7.5 percent.[20] Trade associations representing fiberglass, container, and other product industries frequently announce voluntary recycled-content goals. And where markets are strong and the economics are right, it would appear that the growth of municipal recycling has enabled private industry to voluntarily meet such goals. For example, the American Forest and Paper Association reports that:

> The forest and paper products industry is committed to recycling and has made it a goal to recover 50% of all paper used in the U.S. With the help of millions of Americans who recycle, our industry is quickly approaching this goal. Since the early 1990's companies have invested an estimated $10 billion in new recycling capacity in order to meet the demands for the increased use of recovered fiber. It is estimated that 83% of U.S. paper makers use recovered fiber to manufacture new paper products.[21]

Local Economic Development

Recycling mandates, container deposits (Bottle Bills), agency procurement mandates, and recycled-content requirements are mechanisms for direct government intervention into the recycling market. Each uses laws or goals to alter the balance of supply and demand of recycled materials that prevails at any time. The result, it is hoped, will in the short run be better prices for recyclable materials and supply conditions favorable to industrial development. In the long run, the point of such initiatives is overall growth of recycling industries nationwide.

Local economic development initiatives (Graphic 1-3, page 40) operate on the same general principle, but endeavor to keep the tax revenues, jobs, and positive spillover effects from recycling industries rooted to the municipality, the region, the county, or the state. By and large, they involve programs that reduce the costs associated with starting and operating a private recycling business. These include:

- Tax incentives—the suspension or reduction of property and other local/state taxes
- Grants-in-aid, usually directed to certain expenditures
- Reductions in electricity costs, labor agreements, and real property costs through a third party, with whom the government brokers an agreement

- Technical and bureaucratic assistance with permitting, research and development, and other tasks

- Low-interest and/or tax-free loans

- City contracts that relinquish revenue from sale of municipally collected recyclables to processors, as well as guaranteed minimum-amount provisions that assure processors of a monthly tonnage of recyclables

Graphic 1-3

The New York City Economic Development Corporation and the Empire State Development Corporation are among the agencies that participate in local economic development in New York City.

In some cases, government programs seek to "close the loop"—to facilitate situations in which "locally-generated recyclables are collected, processed in local or regional plants, sold to local remanufacturers, and the end-products are purchased by local private or municipal consumers."[22] This approach sometimes works for businesses targeting deconstruction materials, used clothing, and other reuse items—albeit in very small tonnages. Usually, however, when local economic development assistance is tied to remanufacturing, it ends up assisting businesses that take in feedstock from outside the locality, and who frequently market their end products outside city limits as well. While such projects create jobs and taxes, they do not usually offer outlets for municipal recyclables, which have to seek wider markets throughout the country, and the world.

Chapter Conclusion: Applied Economics

Understanding New York City's position in the larger materials economy is essential to solid-waste–management planning. Given our present political system, it is crucial to recognize that market forces drive recycling in the United States. Citizen and government initiatives have to work around these forces—which themselves reflect the ups and downs of the economy at large.

Market prices fluctuate a great deal, presenting challenges to business and governments alike. The causes of such fluctuation are complex. Supply of and demand for recycled materials and the finished goods made from them ebbs and flows globally, nationally, regionally, and locally. Fluctuating prices reflect constant shifts in who will buy what, and what they will manufacture. In this framework, residential recycling must compete at three distinct levels. A city's residential recyclables compete with its commercial waste for local buyers. Firms manufacturing products from recycled inputs compete both with each other and with virgin producers. Recycling as a waste-management option furthermore competes with refuse disposal, both locally and regionally.

Although it may sound obvious, it is important to keep in mind that New York City is simultaneously within New York State, the greater New York area encompassing New Jersey and Connecticut, on the eastern seaboard, and in the U.S. It is also a player in a globalized economy. The City must adhere to the laws of New York State

and ultimately the federal government. At times, it also benefits from federal and State programs. But economically, trade in recycled materials around the city ignores official borders, moving across state lines and even overseas (Photo 1-9).

In the next chapter, the history of the City's recycling program shows the relevance of this economic background. Like the firms engaged in processing, brokering, or manufacturing with recyclables, New York City has had to grapple with a turbulent, competitive market in materials that spans the globe.

Photo 1-9

An ocean-going vessel at one of New York City's recycling processors prepares to ship scrap metal to overseas markets.

Chapter 2
MODERN HISTORY OF NYC RECYCLING

New York City's recycling program shares many characteristics with programs in other U.S. cities. As in most places, residents actively participate in sorting and setting out paper, metal, glass, and plastic, which are collected at curbside and brought to private recycling plants for processing.

Yet there are other ways in which New York stands out. The City manages collection through a municipal workforce, paid for out of the City's budget. Unlike most large municipalities, New York continues to use manual-loading collection trucks, instead of semi-automated or fully automated vehicles. And New Yorkers put refuse and recycling out in bags or their own bins, rather than standard-issue carts that many jurisdictions use (often in conjunction with automated collection).

Why does New York City have this particular recycling program profile? The program we know today is a product of choices made during the early years of "modern" recycling in the City. To envision NYC's waste-management future, it is important to take a close look at this history; it is full of lessons.

"Modern" Recycling Comes to New York

In 1970, the Environmental Action Coalition, the nonprofit group that organized New York's first Earth Day, introduced "modern" recycling to New York City.[1] In contrast to earlier practices of recovery and reuse of waste materials out of economic necessity, modern recycling reflected a growing, popular response to what was then perceived as a massive and mounting waste crisis.

The decades after World War II saw a skyrocketing of waste generation, both in absolute terms and per capita. Some of this increase was due to the explosive increase in disposable food and beverage containers, as well as excess packaging. As early as the 1950s, producers discovered that doing away with the deposit and refill system for bottled drinks—and adding layers of wrapping, sealing, and boxes—increased the marketability of products and hence profits (Photo 2-1). Overall, the volume and mass of materials produced, sold, and consumed increased in absolute terms. This was driven by the economy's need to expand and, according to some, a change in culture and lifestyle that impelled Americans towards consumption and disposal as a way of life.

Photo 2-1

"No Deposit, No Return" bottles, introduced in the 1950s, offered convenience but had a major impact on litter and solid waste.

Throughout the 1970s and into the 1980s, local recycling centers took hold in cities across the nation, offering sites where residents could drop off paper, metal, and sometimes glass—but there were few municipally run recycling programs. NYC had its own community-based redemption centers, some of which paid money for recyclables based on their market value. Others operated as volunteer drop-off points, with proceeds going to the neighborhood groups that organized and ran them. At that time, New York State had not enacted the Bottle Bill, so revenues from redemption came from contracts set up with buyers of secondary materials. In the early 1970s, this arrangement looked promising. Markets for metal and paper were quite strong, and the centers generated small amounts of revenue. But by the mid-1970s, the bottom had dropped out of metal and paper markets. Hefty government subsidies made up for the losses in revenue that these centers experienced.

Instability of paper markets also explained why DSNY's first experiment with curbside newspaper collection lasted only briefly, from 1970 to 1973. Working in collaboration with nonprofit groups, DSNY set up voluntary programs for newsprint curbside collection in Queens, Manhattan, and Staten Island. At first, the venture was able to cover its costs. But by 1974, the price of paper was so depressed that paper processors did not renew their contracts, and the program was shelved. Community recycling centers limped along after that, educating the public about recycling, but yielding little in the way of revenue or overall waste reduction.

By the late 1980s, there was broad consensus nationwide that dwindling landfill space was creating serious problems for disposal. Although a number of waste historians have since shown that the national perception of "landfill crisis" was unfounded, New York City's unusual geography and density indicated that it faced serious capacity challenges for its waste.[2]

At that time, there were still some incinerators in operation in the City. Local officials, as well as some environmental groups, looked to waste-to-energy as a promising disposal solution. Planning began for a large facility to be sited at the Brooklyn Navy Yard that would take up to half of the City's residential refuse. But incineration was vociferously opposed by other groups. As part of their protest, organizations like the Natural Resources Defense Council (NRDC) demanded that the administration seriously look into recycling as a counterpart—if not an alternative—to energy recovery. Around this time, New York State enacted the 1988 Solid Waste Management Act, which required all municipalities to establish local recycling programs. It was in this context that DSNY began the planning process for a citywide recycling program.

Establishing the Citywide Recycling Program

The Fall of 1986 saw the City's first experiments with curbside recycling collection since the 1970s. DSNY started a pilot program to collect and recycle newspaper, a commodity that was plentiful in the waste stream and for which a market already existed. A voluntary newspaper-only program was launched that year in Community Board 2 in Manhattan. The following summer, each borough had a single-district, newspaper pilot project (Photos 2-2 and 2-3).

In 1987, the Department proposed a citywide recycling program that would add metal, glass, and plastic containers to the newspaper already collected. The Sanitation Commissioner at the time, Brendan Sexton, instructed the DSNY's Office of Operations Planning, Evaluation and Control (OPEC) to outline a set of program priorities, activities, and timetables. In January 1988, OPEC responded with a white paper entitled *New York City Recycling Strategy.* Commissioner Steven Polan succeeded Sexton, and in 1991 issued a follow-up *Preliminary Recycling Plan* reporting on the City's progress. In 1992, the Department released a *Comprehensive Solid Waste Management Plan,* which contained extensive reporting, analysis, and planning for each element of

the City's recycling program. (The CD that accompanies this report contains PDF files of each of these documents.)

During these early years of the recycling program, the Department reviewed various program-design options with an eye toward organizing recycling in a cost-effective and efficient, yet realistic, manner (Table 2-1, page 46). In doing so, it faced a number of questions still debated by recycling programs everywhere:

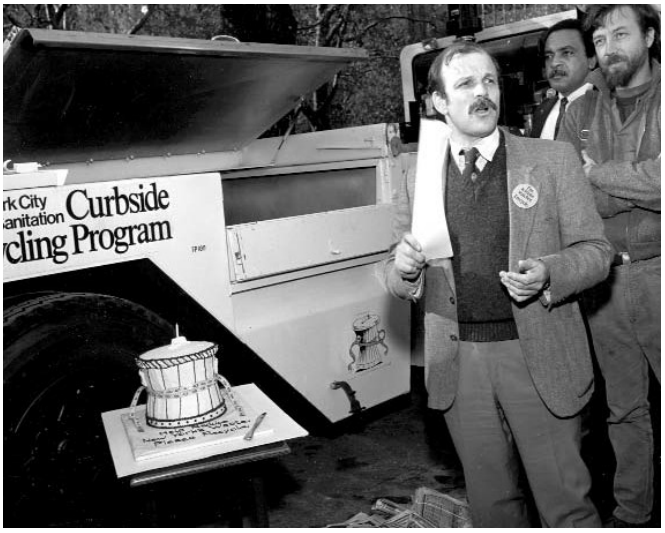
- Which materials should be designated for recycling?
- Should participation be voluntary or required by law?
- What is the most optimal way for residents to sort, separate, and set out recyclables?
- What kind of trucks should be used?
- Should the Department build and/or operate its own materials-recovery facilities, or rely on private processors?
- Were there enough local private processors to take the recyclables that would be collected?

Photo 2-2

In 1986, the Department began a pilot newspaper-recycling program with trucks that look very different than those used today.

Photo 2-3

Brendan Sexton, then Commissioner of the NYC Department of Sanitation, launches curbside newspaper recycling in front of City Hall, November 1987.



Overall, the Department's goal was "to give high priority to [recycling] materials whose removal provides economic, operational, or environmental benefits to other disposal methods,"[3] and to do so in a manner that made sense operationally and financially. How to achieve this goal, however, was anything but self-evident.

Which Materials Should Be Designated for Recycling?

From the outset, it was clear that secondary materials markets would constrain and guide the design of NYC's recycling program. As the Department put it, the decision about what to recycle "hinges largely on the interrelationship between the quantities of various recyclable components in the waste stream and the

Table 2-1
Program-Design Options

Number of sort categories (for generators)

Many				None
> 4	4	3	2	1

Materials designation

Expansive			Restrictive
"Wet/Dry"	"High-Quality Recyclables"	-	"High-Market-Value Recyclables"

Container type

Rigid/dedicated	Plastic/paper bags	No separate container

Number of trucks/collection rounds

> 4	4	3	2	1

Type of collection truck

Non-compacting	Compacting
Multi compartments	Single compartment
Automated loading	Semi-automated	Manual loading

Type of collection system

Curbside	Containerized	Buy-back	Drop-off (staffed or not-staffed)

Type of processing facility

Materials-recovery facility to handle multiple, segregated waste streams	Materials-recovery facility to handle a single, commingled waste stream	Mixed-waste–recovery facility for mixed refuse

Source: *1992 Solid Waste Management Plan for New York City*, page 8-8.

potential 'value' of those materials in the secondary stream."[4] At that time, planners considered "market demand the single greatest limitation to recycling."[5]

In 1988, both regional and export demand for post-consumer recycled paper and metal was modest—but there was a long historical precedent for recycling these materials; scrap metal and paper dealers had traded in commercial discards for years. To a certain extent, this was true for color-sorted glass as well.

Recycled plastics markets, in contrast, were fledgling and tentative, but there was an expectation that capacity would mature as recycling became more entrenched. This would be aided by the fact that an easily identifiable subfraction of plastics—namely bottles and jugs—were being manufactured from HDPE and PET, two of the more easily recyclable resins. In the eyes of the public, plastics were "high profile" because of their relative newness and their non-biodegradability. Although they represented a small fraction of the waste stream at the time, they were exceptionally unsightly and long-lived (Photo 2-4).

Photo 2-4

Early on, NYC's recycling program targeted plastic bottles and jugs. Since most plastic bottles and jugs are composed of HDPE and PET plastics, they are more easily recycled than other kinds of plastics.

Another criterion DSNY used to designate materials is no longer relevant to waste management, but was important at the time—combustibility. In the late 1980s, the City expected to use energy recovery (i.e., burning waste as fuel) as a disposal option for the future. It recognized that if energy-recovery facilities were to be built, it would be advantageous to remove "non-combustibles" such as glass, metal, household bulk, dirt, rubble, and asphalt from refuse to increase the heat yield of garbage. In addition, many in the environmental community were concerned about the risks involved with incinerating plastics. Since that time, incineration has ceased to be considered in waste-reduction planning in NYC. But such considerations did at the time drive the identification of glass, plastic, metal, and construction and demolition waste as advantageous to divert from the waste stream.

The existence or expectation of markets, combustibility, and sheer momentum (most cities included paper, metal, glass, and HDPE/PET plastics in their recycling programs) drove the Department's choice of materials to designate for recycling in 1988. New Yorkers would recycle two groups of materials: paper (newspapers, magazines, and corrugated cardboard) and MGP (metal cans, aluminum foil wrap and trays, glass bottles and jars, and plastic bottles and jugs).

The City's waste stream was unparalleled in size, and as the program began there was a great deal of concern that if the recycling program overloaded the marketplace with materials, prices would fall. As the Department observed, "the potential availability of recyclable materials, if the entire Northeast region embarks on collection programs, is larger than the current capacity of markets to absorb them."[6] Its 1988 white paper on recycling strategy warned that "paper and metal markets will be inundated at a time when growth in both industries is highly dependent on export sales."[7] If that happened, recycling could end up bankrupting itself before it even got started. This did not ultimately take place, but the problem of market volatility and material gluts would continue to pose serious challenges, even as the industry matured in NYC and nationwide.

Should Recycling Be Mandatory?

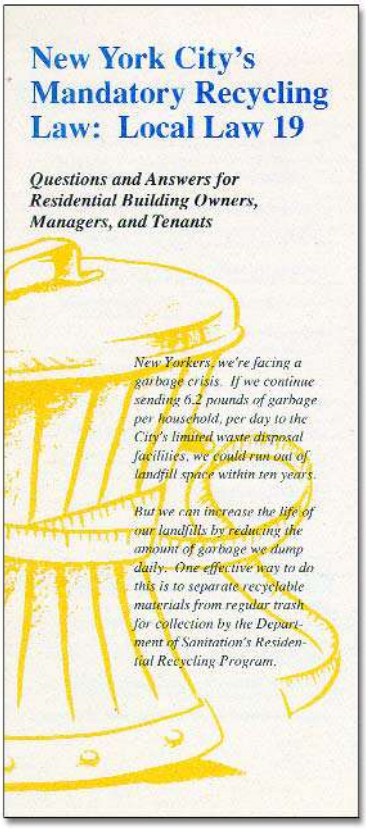
Although the Department had achieved good voluntary participation in its pilot programs, comparative research at the time suggested that "voluntary programs peak at a lower and less consistent level of participation which will not achieve long-term savings."[8] It was clear that "a Citywide mandatory policy would involve the entire population, create awareness and peer pressure and foster the marshaling of the combined resources of all City agencies and community organizations."[9] Consequently, the Department recommended that recycling be made mandatory.

The plans outlined in the 1988 White Paper laid the groundwork for New York City's first recycling law, Local Law 19, which passed in early 1989 (Photo 2-5). The law made recycling mandatory, and set an effective 25-percent mandate for solid-waste recycling in NYC, to be achieved by 1995.[10] It called on the Sanitation Commissioner to conduct further "study of existing markets for processing and purchasing recyclable materials, and the steps necessary to expand these markets."[11] As part of this, DSNY was directed to work jointly with NYC Economic Development Corporation to improve market conditions for recycling in the City by attracting processors with tax incentives, loans, and other inducements.

Local Law 19 also laid out a research agenda. It required the Department to analyze the generation rate and materials composition of residential, institutional, and commercial waste streams. Other provisions directed the Department to undertake public education about recycling, and established a framework for citizens' Solid Waste Advisory Boards. The Law called on the Department to draft commercial regulations that would require private carters to source-separate recyclables. It also required DSNY to establish and fund buy-back/drop-off centers in each borough as a supplement to curbside collection—a venture that, for reasons outlined below, proved costly and inefficient, and was ultimately discontinued.[12]

Photo 2-5

To help New Yorkers understand New York City's mandatory recycling law, the Department issued this pamphlet in 1990.



How Should Residents Sort and Set Out Their Recyclables?

Almost two decades of experimentation with municipal recycling programs nationwide had proved that under drop-off schemes, "it is harder to get and sustain participation and consequently the tonnage collected is usually much lower than that from direct collection."[13] Curbside collection, in contrast, could bring in large tonnages in short periods of time, a clear gain in efficiency.

Redemption centers, also known as buy-back centers, had to rely on contracts with scrap dealers that "traditionally impose[d] minimum quantities and quality controls" that routinely exceeded the actual supply and condition of dropped-off materials.[14] As a result, most "successful" buy-back centers for residential recycling lost money, and needed to be heavily subsidized by local government. Their alternative—voluntary drop-off centers—recovered only a tiny fraction of the recyclables in the waste stream. The time and effort to haul recyclables to a center, especially in New York City where many people do not own cars, meant that only devoted citizens with lots of spare time, energy, and transportation capacity would drop off recyclables. Moreover, both buy-back and drop-off centers would reduce curbside collection efficiency, requiring the Department to essentially pay twice for each ton collected through this method.

Because of the high expense involved, the Department ceased supporting buy-back centers in 1995 and concentrated on implementing the curbside program citywide.

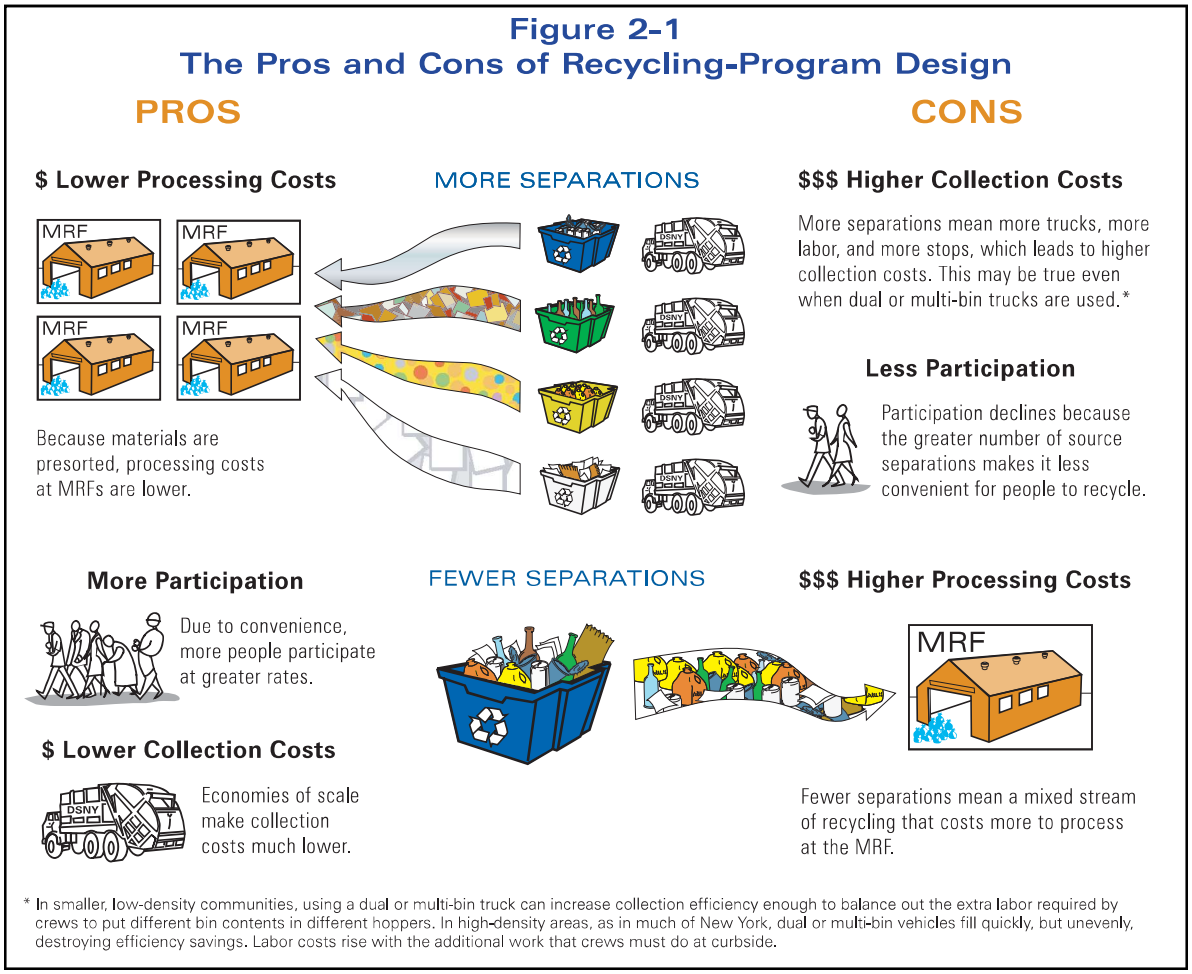
Under a curbside collection scheme, a crucial question would be how actively residents would have to sort recyclables from trash, a process known as "source separation." This was a complicated matter. As Department analysts put it:

> In simplistic terms, the higher the degree of source separation, the lower the level of public participation/diversion, the higher the collection costs, the lower the processing costs, the higher the market revenue. In other words, there are offsetting costs and benefits that tend to cancel each other out.[15]

As this quotation and Figure 2-1 illustrate, a municipality faces distinct pros and cons with regard to the number of recyclable material separations it requires of residents. Increasing the number of separations (i.e., the number of recycling bins/bags each resident will need to use for designated materials) can significantly reduce material-processing costs, but will result in higher collection costs and lower public participation. Conversely, reducing the number of material separations can increase participation and lower collection costs, but will lead to more expensive processing fees.

In the late 1980s, the Department could look to a wide range of program designs in operation across the country (and internationally) for ideas about how best to coordinate this program aspect. A few municipalities collected all trash and recyclables together, requiring no extra work on the part of the resident. Later, at the materials-recovery facility, metal, glass, plastic, and paper would be recovered through a combination of electrical, magnetic, and manual methods.

Figure 2-1
The Pros and Cons of Recycling-Program Design



* In smaller, low-density communities, using a dual or multi-bin truck can increase collection efficiency enough to balance out the extra labor required by crews to put different bin contents in different hoppers. In high-density areas, as in much of New York, dual or multi-bin vehicles fill quickly, but unevenly, destroying efficiency savings. Labor costs rise with the additional work that crews must do at curbside.

Other municipal programs required residents to place all recyclables into one "blue bag," collected along with regular trash bags in a single truck, and sorted after tipping. These were perhaps the most convenient recycling arrangements for residents.

More burdensome were programs that required residents to sort recycling at home into two or more categories. In some places, residents sorted material into "wet" and "dry" fractions to be collected separately. Municipalities sorted the dry fractions for recycling recovery, and disposed of, or (in rare cases) composted, the wet fractions. Other localities employed "multi-material separation," with residents sorting paper, cardboard, metal, glass, and plastic into many separate categories, each in its own bin or bag. Still others designated "MGP" as one group and paper/cardboard as another. As planners at the Department noted,

> Between the two ends of the recycling spectrum [i.e., no separation and multi-material separation] lie decisions about how best to segregate and collect the targeted materials, which in turn drive decisions about the appropriate intermediate processing steps that are required to prepare the materials for their respective end-users.[16]

In New York, requiring people to participate (or risk a fine) would bring with it responsibilities. Participation couldn't be so burdensome that it would unfairly tax residents' time and labor. Yet there were vast advantages in having residents do some source separation at home. Scenarios like single-stream recycling, mixed-waste processing, and to a lesser extent, wet/dry separation, were rarely in use at that time. Research on them showed contamination of recyclables with unusable waste products, higher labor costs (due to the extra work needed to sort recyclables from each other and from contaminants), and a much lower quality yield. Separating paper from MGP was a more proven method of maximizing the value of collected materials.

Moreover, with over 70 percent of the City's housing units in apartment buildings (five or more units), there was also the question of the division of labor and responsibility among residents, superintendents, and building owners. Was it fair to fine owners or supers if residents failed to comply with the law? And how could non-complying residents be identified anyway? This problem, unique to multi-unit buildings, presented a conundrum.

Factoring in burdens to residents, supers, and owners; collection costs; and the costs for post-collection separation and processing, the Department recommended the collection of designated metal, glass, and plastic containers in one stream; and newspapers, magazines, and corrugated cardboard in a second. Refuse would constitute a third, separate stream. This arrangement was set forth over other options because of the high costs and/or low quality of recovered recyclables associated with alternatives. As the Department put it in 1988, "this method of collection strikes a balance between easy participation and collection and easy separation and processing."[17]

How Often Should Recyclables Be Collected and What Type of Trucks Should Be Used?

In addition to how residents would set out their recyclables was the issue of how often these recyclables would be collected, which would have direct bearing on the cost efficiency of the program. Each additional collection would bring with it labor, fuel, and maintenance costs. Picking up recycling weekly would be popular with residents, but would quickly drive up expenses, and increase local truck traffic on already busy streets. Less frequent collection avoided these ills, but meant that residents would have to store recyclables for days or weeks at home.

The Department consequently faced three options: (1) the "substitution [of a recycling collection] for one regular collection" one day per week; (2) the addition of one recycling collection per week on top of regular collection; and (3) the concurrent collection of refuse with recycling using three-bin trucks. A comparison of collection costs and benefits at the time calculated the first option as most cost-effective, but concluded that a mix of strategies would probably have to be used, given the variation in housing density among the city's diverse neighborhoods.[18] Throughout most of the 1990s, garbage was collected two or three times per week, while recycling was collected weekly or biweekly (every other week). However, in 1999 citizen pressure led to the implementation of weekly recycling collection in all 59 districts of the City (a service that, due to the City's fiscal crisis, was suspended in July 2003, and resumed again in April 2004).

Another issue in designing the program was the choice of trucks. Then, as now, there were many varieties of "garbage truck," each of which had different advantages and drawbacks when used in conjunction with recyclables collection. Trucks could have one, two, or several separate compartments. They might be compacting or non-compacting. Compacting refuse is widely practiced because it increases collection efficiency by allowing more material to be loaded into a single truck. But compacting recyclables entailed problems—broken glass, squashed cans, and mangled plastic bottles (frequently with contents still in them) made for a messy recyclables stream. Another decision was whether to stick with the manual trucks the Department was using (which required workers to toss bin contents and bags directly into hoppers) or to switch to automated collection vehicles that helped crews to lift, tip, and replace standard-issue containers.

The 1992 *Comprehensive Solid Waste Management Plan* noted that "In New York City, the use of large-capacity trucks with compacting capability is essential for an efficient citywide recyclables collection system."[19] "Efficiency" here meant minimum labor hours, fuel gallons, vehicle wear, and air/noise pollution per unit volume of refuse collected. Of course, compacting would entail problems of glass breakage, but the Department observed that "collection cost-savings far outweigh any added processing costs or lost material revenues."[20] And manual trucks would be essential, since automated collection could only work if residents used standard-issue bins and where there was no street parking.

The infeasibility of distributing and maintaining the use of millions of carts argued against automated collection. Automation would also require keeping cars off streets on collection days. This would be highly disruptive to city motorists, especially as DSNY's street-sweepers operate on a far different schedule than curbside collection, and automation would require a second set of alternate-street parking rules to make way for refuse and recycling trucks.

So the Department decided to collect recyclables using compacting, single-bin, manual rear-loaders (Photo 2-6), with future research to be conducted on dual- and three-bin trucks. Dual-bin trucks were eventually introduced in over half of the City's sanitation districts.

Photo 2-6

In order to efficiently collect recyclables on busy city streets, the Department of Sanitation decided to use rear-loading trucks that compacted recyclables.

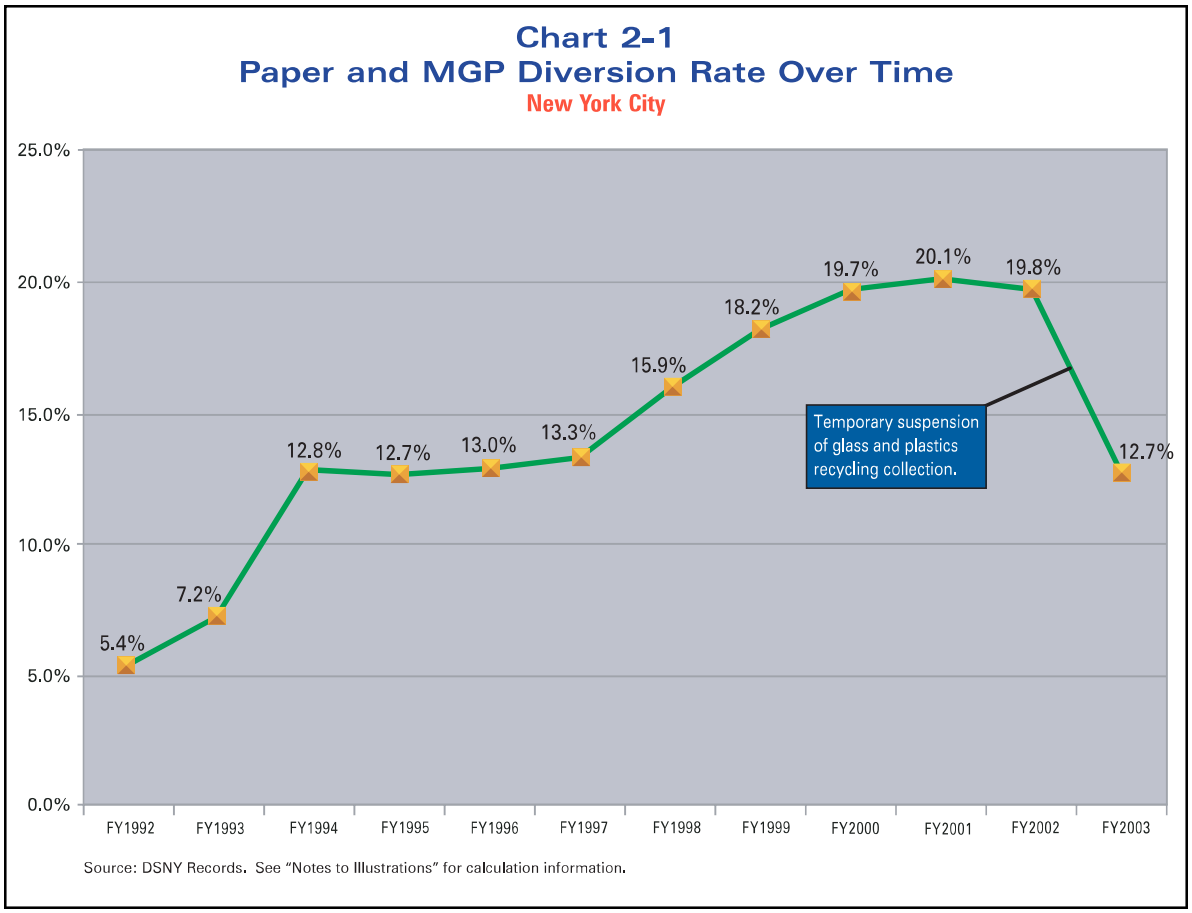
Recycling Becomes a Way of Life for New Yorkers

The challenges related to organizing the program and getting residents to participate would continue throughout the 1990s, but would be eventually worked out with repeated waves of public education (see Appendix IV for more information on NYC's public information efforts about recycling), standardization of requirements throughout the five boroughs, and uniform collection frequency citywide.

In 1991, when 40 out of 59 community districts, or over two million households, were receiving curbside/containerized recycling collection service, the diversion rate was six percent. Although New Yorkers did not generate the tonnages mandated in Local Law 19 by the specified deadlines, over the rest of the decade, the diversion rate would slowly climb, reaching 20 percent by the turn of the century (Chart 2-1).

Survey research of tens of thousands of New Yorkers confirmed that by the late 1990s, the Department's public education efforts were well received and making slow but steady progress in explaining the fundamentals of the program. Details of these efforts are reported in *NYC Recycles!,* and *Recycling, What Do New Yorkers Think?* available on the Department's website.

Moreover, as will be discussed in greater detail in the next chapter, the attainment of a 20 percent diversion rate in 2000 was consistent with rates achieved for *metal, glass, plastic, and paper* recycling in nearly every other U.S. city, including Seattle and San Francisco. What's more, 20 percent diversion represents an above-average diversion rate for multi-unit recycling nationwide. The diversion rate, in short, reflected what the surveys measured: recycling was becoming a "way of life" for New Yorkers.



Processing Recyclables: Early Problems

Not As Easy As Expected

In contrast to the relatively easy task of promoting resident participation, finding the capacity to accept thousands of tons of recyclables each day posed complex challenges. The assumption of the authors of Local Law 19 had been, "if you collect it, they will come." "They" would be recycling processors willing to pay the City enough per ton to make recycling cost-effective. In mandating tonnages that the Department had to collect, the City Council presupposed that these processors were out there. This was not entirely true. As the DSNY wrote in 1991:

> …the underlying premise of many public recycling programs—including New York City's—has been that if a supply of recyclables is created, investment dollars will flow to manufacturing facilities and processes that utilize recyclables. However, the validity of this premise is a function of comparative manufacturing costs and revenues generated.[21]

Nonetheless, among politicians, environmental advocates, and citizens groups, there were high expectations that New York City's size and clout would have a massive impact on market conditions, and would make recycling here very profitable. John Schall, a visiting professor at Yale University who consulted on the City's new solid-waste–management plan, summed up the mood of optimism.

> Scale is everything in this kind of program, and this will have the biggest scale you ever saw. In one stroke you will be able to educate everyone the same way, and you will send a strong message to mills and recycling plants that New York has resources that no other city can possibly compete with. That can turn the city into the world center of recycling.[22]

To many observers it seemed only natural that processors would seize on the opportunity NYC offered: thousands of tons of recyclables every day. But to DSNY, there was reason to be cautious against leaping to the conclusion that either capacity or markets would develop quickly:

> The City has only limited opportunities to speed the development of recycling markets. While the private investment decisions necessary to productively utilize recyclables can be motivated at the margin by local incentives, they are more fundamentally based upon the relative costs structures between recyclables and virgin materials, historical biases and federal tax preferences toward new materials, and prevailing economic conditions.[23]

The economic viability of recycling was complicated by the very real possibility that New York's massive waste stream would overwhelm fledgling secondary markets, driving prices paid for recycled materials down as supply flooded in. In a 1991 Recycling Plan update, the Department warned that the City would have to lose money on recycling before markets stabilized, writing, "the City must be prepared to bear increased marketing costs for the foreseeable future."[24] And it prepared New Yorkers for the fact that there would be a time lag between recycling program success and the development of facilities to process what is collected. Yet the Commissioner at the time remained hopeful that, with time, markets would develop and processing capacity would be established in New York City. "Based on what we know to date…it is possible, even probable, that with time and experience, these costs will decrease."[25]

Limits to Private-Sector Processing

As soon as the recycling program went into effect, DSNY established contracts with private paper processors already at work in the New York area for paper processing, paying roughly $27 per ton in 1990 dollars (the equivalent of $37 today) for processing, with no revenue in return. Most of the MGP processing was carried out under agreements with a handful of private MRFs in Newark, New Jersey and Westbury, Long Island. In these cases, the Department paid a $40 to $60 per ton processing fee, forgoing any revenue-sharing.[26]

In the existing private recycling sector in the City in the late 1980s and early 1990s, firms dealing with paper and scrap metal were far better established than those processing other materials. The reason was historical precedent (Photo 2-7). Throughout the U.S., businesses that generated large quantities of used paper and cardboard, as well as scrap metal, had always sold these materials to dealers. Recycling of these materials, while not considered an environmental policy, had been practiced within the paper and metal industries since they began.

What was new in the 1970s and 80s was that residents were getting into the act on a far larger scale than the occasional newspaper or can drive for charity, or the limited drop-off of recyclables at the local recycling center. The now-growing stream of newspaper, magazines, cardboard, and cans that residents participating in curbside recycling would contribute was still very much like the materials that these processors had been collecting for years. No major revamping of recycling facilities for them was necessary. So as long as prices held up, paper- and scrap-metal–recycling capacity was there.

Similarly, recycled glass had in the past enjoyed a strong reuse industry, with refillable bottles standard for milk, beer, and soda. With the advent of disposable cans and bottles in the 1950s and 60s, the practice of refilling had declined to almost nil (Photos 2-8 and 2-9). In the late 1980s, some glass recycling was still taking place, but it depended on clean, presorted feedstock. Given the fact that virgin glass was relatively inexpensive to

Photo 2-7

Left: A scrap-metal dealer in the 1930s inspects the household items and machine parts he has collected for scrap. Right: A New York City "junk man," circa 1920, with a load of paper for recovery.

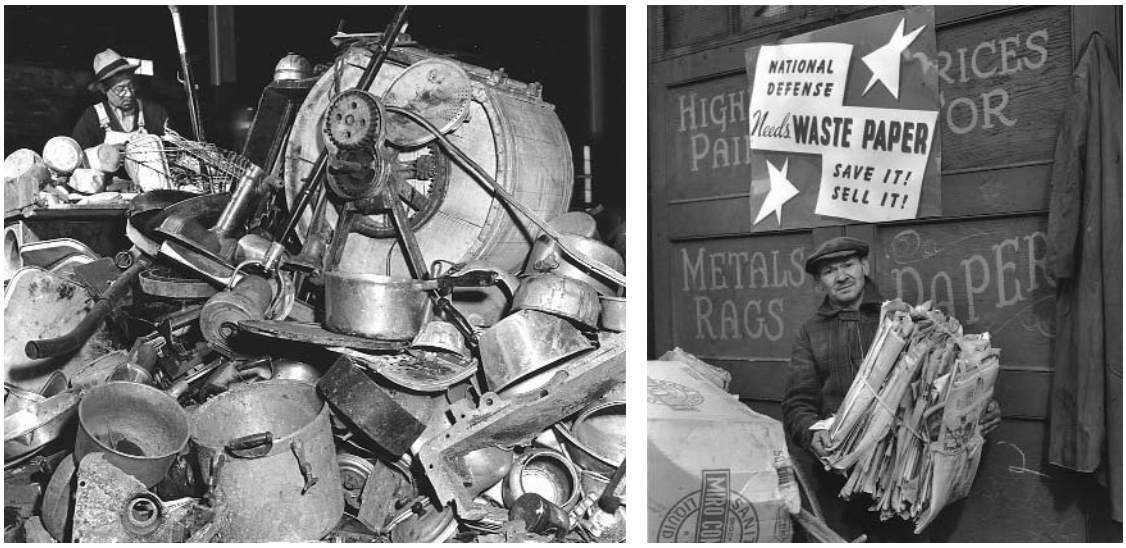
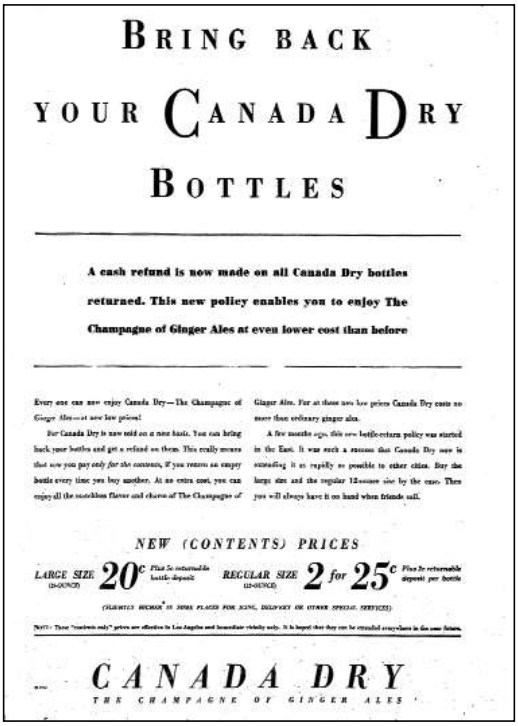


Photo 2-8

Below: A milk delivery man handing a man a crate of milk bottles, 1929. Refillable bottles such as these were widely used at that time. Right: Bottles that were not collected as part of deliveries were redeemable for a deposit, as indicated in this 1932 Canada Dry ad from the *Los Angeles Times.*



BRING BACK
YOUR CANADA DRY
BOTTLES

A cash refund is now made on all Canada Dry bottles returned. This new policy enables you to enjoy The Champagne of Ginger Ales at even lower cost than before

Every one can now enjoy Canada Dry—The Champagne of Ginger Ales—at new low prices!

For Canada Dry is now sold on a new basis. You can bring back your bottles and get a refund on them. This really means that now you pay *only for the contents*, if you return an empty bottle every time you buy another. At no extra cost, you can enjoy all the matchless flavor and charm of The Champagne of Ginger Ales. For at these new low prices Canada Dry costs no more than ordinary ginger ales.

A few months ago, this new bottle-return policy was started in the East. It was such a success that Canada Dry now is extending it as rapidly as possible to other cities. Buy the large size and the regular 12-ounce size by the case. Then you will always have it on hand when friends call.

NEW (CONTENTS) PRICES

LARGE SIZE (25-OUNCE) 20¢ Plus 5c returnable bottle deposit
REGULAR SIZE (12-OUNCE) 2 for 25¢ Plus 2c returnable deposit per bottle

(TELEPHONE HICKORY 52 000 PLACED FOR SIZING, DELIVERY OR OTHER SPECIAL SERVICES)

NOTE: These "contents only" prices are effective in Los Angeles and immediate vicinity only. It is hoped that they can be extended everywhere in the near future.

CANADA DRY
THE CHAMPAGNE OF GINGER ALES

produce, this meant that glass recyclers relied on industrial scrap glass, commercial glass, and a small amount of presorted consumer glass from drop-off centers.[27]

Plastics recycling, even in 1991, was more a concept than a practice—with unproven technologies and few processors. NYC's first drop-off centers, for instance, accepted only metal, paper, and glass—the same was true of many programs throughout the country in the 1970s and 1980s.[28] As late as 1987 industry analysts observed that:

> Plastic recycling is in a relatively early stage of development compared with other materials for several reasons. Substances like aluminum, glass and steel have been used by industry much longer, and reclamation for these technologies are more advanced. The volume of plastics used to make bottles and other containers also is still considerably smaller than the more traditional materials, and the recycling of plastics consequently lags far behind.[29]

Photo 2-9

By the late 1950s, deposit bottles were replaced by "no deposit, no return" cans which were considered more convenient.

Like glass, existing plastics recycling largely targeted clean, presorted streams (from sources like restaurants or bottle-bill redemptions)—not the commingled residential MGP that needed extensive processing.

Yet while there were industries for recycling separate streams of paper, metal, glass, and plastic, in the early 1990s, what had not developed was an industry for sorting and processing commingled metal, glass, and plastic recycling collected from residents in one stream. Scrap-metal dealers, glass-recovery firms, and plastics recyclers did not have experience sorting discarded, metal, food or beverages containers from plastics and glass, nor were they prepared for the putrescible materials in this stream that had to be cleaned and disposed of after processing. These firms were interested in metal, glass, and plastic in the MGP stream, but only after such materials were sorted out, cleaned, and baled.

One method for the City to gain some control in this situation was to develop its own processing capacity. If it could ensure that facilities within New York City would reliably accept its recyclables day in and day out, and share any resulting profits, the City could proceed to build its program with more confidence than if it relied completely on the willingness of private firms to come forward.

City MRFs

In the late 1980s, the Department had to face the fact that "New York City has no private sector separation facilities for commingled [i.e., MGP] residential recycling."[30] While newspaper processors had operations in and around New York, it looked as if the City itself would have to construct processing facilities, or at least transfer stations, for commingled metal, glass, and plastic.

It was not surprising, given this scenario, that the City in the early 1990s viewed publicly owned facilities as an integral part of New York City's recycling future. The Department's first public MRF project was an Intermediate Processing Center (IPC) in East Harlem, which it constructed and operated under contract with Resource Recovery Systems, Inc. The Center, located at 242 East 128th Street, opened in 1988 with a processing capacity of 20 tons per day (Photos 2-10 and 2-11). Within a year, the plant was handling around 120 tpd running

Photo 2-10

Exterior shots of the East Harlem Intermediate Processing Center show its small layout.

multiple shifts. The Department paid processing costs and any additional operating costs of the facility, and was entitled to receive a portion of any revenue the company made from the marketing of sorted and baled materials.

The mix of private and public arrangements were, for the time being, enough to handle the City's MGP recyclables stream. But more capacity, and more favorable economics, would soon be needed. In a 1990 interview with the *New York Times,* then Commissioner Steven Polan called the lack of processing capacity "the single most significant hurdle" for the recycling program, saying that "the success of the department's short- and long-term plans depends upon the availability of sufficient public and private processing capacity as well as markets for the materials."[31]

In response, Polan outlined plans to construct several additional public MRFs. These would be owned, financed, and overseen by DSNY, though constructed and operated under contract to private sector firms. The first two would be sited in Staten Island and Brooklyn. In the long run, it was anticipated that the City would need "as many as ten large-scale processing facilities to accommodate the tonnage" of expanding recycling programs—at least five of which would be City-owned.[32]

Despite the existing availability of private processors for paper, it made sense for the City to consider taking over portions of this business along with MGP processing. Much would be gained by "developing new facilities to sort, bale and transport our newspaper directly to paper mills, rather than relying solely on short-term contracts with intermediate brokers."[33] The volatile paper market, at a dismal low in 1990, had made this necessity clear—the City paid dealers as much as $27 a ton to take paper at that time.[34] And the Department

Photo 2-11

Interior shots of the East Harlem IPC, showing the rudimentary sort technology in use in the early 1990s.

declared that "Sanitation has defined the development of newspaper de-inking capacity as its highest market development priority."[35]

DSNY began considering the construction of an MRF at Fresh Kills in 1990. By early 1992, it had issued a Request For Expressions of Interest (RFEI), to which a number of firms responded with plans for large processing facilities. The 1992 *Comprehensive Solid Waste Management Plan* reiterated the pressing need for a public recycling facility to serve sanitation districts in southwest Brooklyn and Staten Island, noting that it would be essential to have capacity to process both MGP and paper, as well as for the manual color-sorting of glass. An RFP followed, and the Department selected Resource Recovery Systems of Connecticut as the builder/operator. Plans for construction continued through 1993, and the Department applied to the NYS Department of Environmental Conservation to fund half of the $17.5 million price tag for capital costs. It was estimated that if a 300-ton-per-day capacity were achieved, processing would run the City $39.70 per ton with an additional $11.30 per ton in capital costs over twenty years. Revenues, in turn, would generate about $21.73 per ton, for an overall net cost per ton of around $29. And if capacity were increased to 600 tpd (which would raise capital costs to $20 million), this net cost would fall to only $16 per ton, due to economies of scale.[36]

Despite the envisioned efficiencies, fiscal constraints in 1994 caused the project to be downsized. This was based on the observation that when transportation costs were figured into a 300-tpd facility, utilizing private MRFs for Brooklyn's recyclables was shown to be more cost-efficient than shipping them to a city facility in Staten Island (Table 2-2).

In addition, Staten Island Borough President Guy Molinari—at that point deeply engaged in the local fight to close the Fresh Kills landfill—voiced objections to the transport of any additional out-of-borough waste to Staten Island. As a result, the scope was reduced to a smaller, Staten-Island-only project. Yet just at that time plans for Visy's paper-only MRF, also to be located in Staten Island, began to take shape. In order to secure the Visy plant, the city agreed to supply it with Staten Island paper, meaning that the envisioned MRF's scope would be further curtailed. At that point, the economies of the system could not be worked out. By the end of 1994, the project was officially cancelled.

The vision of a system of public MRFs also started to come under fire by the business community. In 1993, the private recycling industry, organized under the aegis of the New York/New Jersey Coalition of Recycling

Table 2-2
1994 Cost Comparison Between Proposed Staten Island MRF and Existing Private MRFs

Sanitation districts served	Tons per day	Proposed Staten Island MRF		Existing Private MRFs	
		Cost per ton	Total	Cost per ton	Total
Staten Island districts	180	$74	$13,320	$102	$18,360
5 Brooklyn districts	220	$91	$20,020	$ 52	$11,440
Total	**400**		**$33,340**		**$29,800**

Source: Internal DSNY calculation, July 11, 1994.

Enterprises, started publicly challenging the "$125 million city program to build five publicly owned centers in five boroughs."[37] Asserting that their own MRFs were running below capacity, they sought to block DSNY's requests for capital funds in the City Council. DSNY responded that "city-owned plants would handle more sophisticated sorting and separating, cost less to operate, process more materials more efficiently, and stimulate the sagging market for recyclables," and would also cut down on transportation costs for DSNY trucks.[38] The Coalition, joined by the Chamber of Commerce, countered that "instead of spending tax dollars, the City should merely set the regulatory standards and let the free market reign."[39] The position of environmental groups was neutral. As NYPIRG put it, "we have no preference…we just want to get (recycling) done."[40]

In May of 1994, the East Harlem IPC was permanently closed. At that point six years old, the facility was considered costly and obsolete, with very high per-ton processing costs. The Times noted that "the decision came as a blow to community leaders in East Harlem who had lobbied for city, state and Federal money to build the plant in 1985 as a public-private partnership."[41] It didn't help that 1994 was experiencing a very poor recyclables market, with "recycling centers across the country…backed up with empty plastic soda bottles, glass containers, cans, and newspapers."[42] Manufacturers were, in fact, finding it cheaper to buy raw materials than recycled ones.[43]

Glassphalt: A Public Outlet for Glass

In contrast to the aborted efforts to build public MRFs, there existed for a time a public arrangement for using sorted glass that worked well. The problem of glass breakage and contamination was seen early on in the recycling program, leading recycling industry executives to complain that "the city is now mixing glass, plastics and aluminum cans…a process that breaks and contaminates the glass, making it less valuable than it could be."[44] But as the 1992 *Comprehensive Solid Waste Management Plan* pointed out, extensive testing by DSNY had confirmed that "only compacting trucks are feasible for New York City. Non-compacting trucks…are unduly inefficient and expensive."[45] What was needed was to find a beneficial use for the mixed cullet in the form it was collected. Fortunately, soon after the recycling program went into effect, the Department of Transportation (DOT) began accepting glass from firms contracting with DSNY, using it to produce glassphalt at its Brooklyn facility (Photo 2-12). Further demand for mixed, broken glass was created by new City requirements for paving contracts, which required bidding firms to use mixed cullet in their road material.

Photo 2-12

The NYC Department of Transportation produces asphalt at its Hamilton Avenue plant in Brooklyn. Prior to 1997, the plant used the glass collected through the City's recycling program to produce "glassphalt."

The DOT had mixed success using the cullet. Asphalt production is a science; to make paving that can be applied correctly and will stand up to sustained use requires achieving the right mix of stone aggregate and asphalt concrete (AC, commonly known as "tar"). Although pretty to look at in the finished product,

glass as a substitute for stone aggregate can be inferior, especially if the size of the cullet shards is larger than a quarter inch, which it frequently was in the early days of the recycling program (Photo 2-13). Tar does not adhere as well to glass as it does to stone, leading to premature disintegration of the glassphalt roadway.

Some of these problems were alleviated when the DOT imposed more stringent crushing specifications on DSNY contractors. But these specifications, and the additional processing cost associated with achieving them, led the contractors to deliver cullet inconsistently (crushing it when they could, and at times seeking other outlets for it as aggregate outside the City). The resulting fluctuation in deliveries meant that DOT had to store large stockpiles of cullet in some periods, and ran low on others.

Despite these problems, the use of cullet in asphalt production might have continued had several events not transpired to make recycling *asphalt* (as opposed to glass) a priority. The first was the DOT's increasing need to tear up streets before repaving them, since repeated applications of new asphalt over the years had moved the street level closer and closer to the level of the curb. The work that ensued led to a surge in millings that the DOT would have to use or dispose of in some way. The second development was improved asphalt recycling technology, so that as much as 40 percent of the aggregate-tar mix could be substituted with millings, which are also known as Recycled Asphalt Product (or RAP) (Photo 2-14). The DOT's Brooklyn Asphalt Plant underwent redesign between 1994 and 1997 to install the new technology, and became a major outlet for the large surplus of stockpiled asphalt at sites throughout the City, and the steady stream of new millings from ongoing road work.

While this was taking place, the City decided to, and began to, close the Fresh Kills landfill. This effectively eliminated a cheap disposal outlet for excess millings, both as waste and for use as temporary road-building material for access to the active face. These developments, in conjunction with the quality problems and uneven supply that the DOT had experienced in the past, led to its decision to stop using cullet in

Photo 2-13

During the mid-1990s, many of the City's streets sparkled with bits of glass. But there were problems with the quality of this material.

Photo 2-14

A pile of Recycled Asphalt Product (RAP), waiting to be crushed and screened for reuse in new asphalt production by the NYC Department of Transportation.

production. Ironically, the coming of asphalt recycling meant the downfall of mixed-cullet recycling, with processors now looking to end-uses for cullet, such as drainage and alternative daily cover at landfills outside the City. Today, the DOT recycles 160,000 tons of RAP per year through new asphalt production, and delivers another 270,00 tons of asphalt and millings per year to DSNY for use in surfacing projects at its various facilities.

Early Initiatives to Develop Private Capacity to Process NYC Recyclables

While the City pursued the idea of public MRFs, the Department still considered it essential to supplement City resources with more and better private capacity, brought about through the restructuring of contracts. In 1990, the Department noted:

> …the city is offering short-term contracts to processors [of MGP] but this makes it harder for processors to participate. Many do not have the capacity to handle the amount of material the city is generating, and without longer term contracts, they have little incentive to invest in the extra equipment for such daily loads.[46]

Private firms, especially those that used recycled materials as inputs to production, would have different goals and constraints than a public MRF. For one, since their bottom line was profit in a competitive and fluctuating market, their focus would be on guaranteed supply and consistency of input, much like any other type of manufacturing. This would create both opportunities and challenges, as the Department remarked:

> We know that end users of secondary materials prefer certain materials specifications and guaranteed long-term supplies, particularly if large capital investments on their part are required in order to expand capacity. Our goal must be to develop ways to respond effectively to those needs.[47]

Promoting Recycling Through Economic Development

Developing private capacity also presented the possibility of stimulating industries that combined manufacture with processing. If firms that accepted residential recyclables could use them to produce products on site, this would keep economic benefits within the City in the form of lower costs for DSNY, as well as jobs and tax revenues. In theory at least, keeping secondary inputs local would result in local environmental benefits—less truck transport, lower energy use, and reduced emissions (provided the industries supplanted local virgin production).

To bring this about, it was widely believed at the time that the City's direct intervention in the market as a buyer of recycled products would play a significant role in creating demand. A 1991 Department statement advocated "increase local usage of recycled materials, through expansion of traditional City procurement techniques to encompass a broader range of materials (e.g., plastic wood for a variety of products) and through the development of nontraditional "markets" (e.g., using compost for landfill cover and for reclaiming degraded areas), as in the past we have developed 'glassphalt.'"[48] In this scenario, hopes were high that if the City could mobilize its massive purchasing power and need for material goods, facilities and markets would follow.

In addition, in the early 1990s the Department also expected that policy implementations at the federal level would consolidate demand for recyclables nationwide. Recycled-content legislation, product-use bans, preferential procurement policies, taxes on virgin materials, and product-labeling requirements, were among the

initiatives that the Department considered promising. In fact, the DSNY's 1992 *Comprehensive Solid Waste Management Plan* explicitly called on the federal government to pursue the development of national recycling markets within the context of the Resource Conservation and Recovery Act (RCRA), the major piece of federal legislation governing solid-waste management. The Department voiced its strong support for Bill S. 976, an initiative designed to "establish annual recycling utilization rates for manufacturers, importers, and distributors of packaging and paper products," so as to create demand for products throughout the country.[49] None of these initiatives, however, ultimately passed.

In early 1992, Emily Lloyd replaced Steve Polan as commissioner. Lloyd had an extensive public sector background in local economic development. Her tenure coincided with the most intense period of interest and work in this area the City would see in the 1990s and beyond. Lloyd spearheaded a focused project to develop recycling business infrastructure, with the goal of "using more of New York's solid waste materials to make products locally, instead of sending the separated trash to recycling plants around the country."[50]

In late 1992, Mayor David Dinkins created a task force to promote economic development for recycling industries, led by the NYC Economic Development Corporation President and a business advisory council. He also established an Interagency Task Force chaired by a Deputy Mayor to "coordinate the work of city agencies involved in recycling and economic development."[51] Together, their charge was to:

> …lure recycling plants…find large, cheap plots of land; counter high operating costs; change public-sector purchasing policies; improve the quality of recyclable materials; find the right markets; and speed up the city's time-consuming approval process.[52]

In 1992 and 1993, there was a great deal of activity on this front. The City sponsored three conferences to bring together recycling industry representatives and public officials. The Empire State Development Corporation published "Pipeline," a bimonthly report of all recycling-related companies who had sought public assistance to locate in NYC. There was talk of developing a recycling industry development council to coordinate information, navigate city bureaucracy, identify joint-venture opportunities, and secure a dedicated source of low-cost energy from New York Power Authority.

The NYC Economic Development Corporation sponsored a report proposing a recycling industrial park at Bush Terminal, Brooklyn, to take advantage of the stream of processed recyclables that the City's MRF would provide.[53] On the private side, local firms (most of them in the paper-recycling or garbage-hauling business) were gearing up for increased capacity. Star Recycling of Brooklyn was expanding and upgrading equipment, Brooklyn's Waste Management of New York (not affiliated with Waste Management, Inc.) was "busy buying up buildings in the Williamsburg section."[54] New national players like Browning-Ferris Industries and Waste Management, Inc. (WMI) were "moving to take advantage of the growth," consolidating the foothold they had gained in the commercial sector in the wake of Mayor Giuliani's crackdown on corruption among trade waste carters.[55]

At the state level, the Office of Recycling Market Development (ORMD) funded several feasibility studies of recycling options in the New York area. Several involved the Community Development Organization Bronx 2000, which was at that time sponsoring the R2B2—a facility handling deposit plastics, wood pallets, and other recyclable materials from clean (i.e., not residential curbside) waste streams. Between 1992 and 1993, ORMD made several small grants to the organization to study disposable diaper recycling and dry-cell battery reconditioning, neither of which proved to be workable environmentally and financially.

1993 Task Force Report

One of the Task Force's most visible accomplishments was a 1993 report conducted by NYU's Urban Research Center and Appleseed, a nonprofit economic development group (Photo 2-15).

Photo 2-15

This report, issued by NYU's Urban Research Center and Appleseed, presented one of the best analyses of NYC's potential for recycling economic development. (A pdf version of the NYU report can be found on the CD accompanying this report.)

The work, entitled "Exploring Economic Opportunities in Recycling," outlined a bold vision of "a new blue-collar industry…that could generate up to 4,000 new jobs"[56] in New York, reinfusing the City with an economic vitality that decades of deindustrialization had eroded. (A pdf copy of this work can be found on the CD issued with this report.) The City's massive size meant a concentration of supply of recyclables and (for some products) a concentration of demand for recycled products. In addition, its concentration of marketing and distribution networks could, under the right conditions, provide opportunities for either vertical or horizontal integration of processors and manufacturers.[57]

But the report's authors also acknowledged the disadvantages of NYC as an industrial location. Costs were substantially higher for land, construction, electricity, labor, and living expenses than almost anywhere else in the country. NYC's density meant extremely strict restrictions on air and water emissions. Permitting and city contracting requirements were complicated and discouraging, especially in light of "new land use planning and development procedures that have dispersed governmental authority more widely among independently elected and appointed officials."[58] This made risking venture capital in the already volatile recycling market an even more precarious undertaking.

In contrast to the naive "if you collect it, they will come" approach, the NYU Report provided a sophisticated analysis of the kinds of economic development that could realistically be expected to emerge in New York City. It noted that "while the collection of secondary materials is inherently a local activity, there is no guarantee that the expansion of sorting and consolidation facilities will occur within the city's boundaries."[59] In the authors' opinion, established secondary materials industries would in general not be likely to locate in New York, since "there may be opportunities to increase their consumption of recycled material; but there is no reason to expect that this would either increase the demand for their product or alter existing patterns of production."[60] Overall, the report noted that "industry is much more likely to grow through incremental capacity expansion at existing plants [elsewhere], and there is no existing [recycling] production base within the city from which the industry could grow."[61]

There were, however, some potential exceptions to this tendency. The first was in newsprint production, which could operate at smaller scales than virgin mills and had a natural balance of local supply (readers) and demand (newspapers). A second possibility was the manufacture of plastic "intermediate goods" (processed recycled plastics that can be used in product manufacturing, such as plastic pellets) from recycled plastic bottles. In part because of the lack of development in the industry, plastics processors and manufacturers—in theory—could operate on the small scale needed to survive in New York's dense environment.

In general, the NYU report stressed the "importance of small and mid-sized companies already doing business here as a prime resource in the development of recycling-related industries in New York."[62] These companies were used to the adversities of a NYC location, among which was "the city's difficult business environment."[63] Such businesses had learned to cope with "fragmented government and public bureaucracies whose priorities are (often necessarily) shaped by the needs and demands other than those of the business community."[64] They knew that communities tended to challenge firms operating in "older, densely-developed neighborhoods where attitudes towards [recycling] operations, and to the possibility of expansion, are at best ambivalent, especially where their operations generate noise, dust and truck traffic."[65] And they were at least somewhat prepared for local opposition to any facility associated with garbage, even environmentally friendly recycling plants. The reality of public opinion was such, noted the report, that "even those recyclers that do not produce such noxious effects can suffer from association in the minds of many citizens and public officials with the 'garbage' business."[66]

In this regard, the 1993 NYU report advocated including community-based economic development organizations to the fullest in the siting and planning process. It also identified small segments of the waste stream (such as textiles and household appliances) that community organizations might collect separately from the other recycling, for low-tech processing. It encouraged the City to think about recycled-product procurement not only in terms of content, but also in terms of New York City content, recommending that it "permit limited sole-source procurement of locally manufactured products."[67] And it suggested that the City might also consider developing "pre-packaged" industrial sites before firms chose to locate—to avoid the Environmental Impact Statement (EIS), Uniform Land Use Review Procedures (ULURP), and other approval procedures that would delay new facility start-ups. Finally, it stressed the importance of offering more stable and predictable City contracts to processors already laboring under difficult circumstances.

The authors of the report concluded by reminding the Task Force that the next step was theirs. Although the NYU scholars had identified opportunities for recycling-related development, and made broad suggestions about the shaping of waste-management and economic-development policy, they left it up to the Task Force to follow up with specific recommendations for legislative, regulatory, and administrative action. Over the coming years, New York City, and New York State, would struggle to develop recycling markets—and local remanufacturing would not, by and large, develop as an outlet for NYC's commingled recyclables. An examination of some successes and failures in this area of economic development shows why.

City Procurement of Plastic Products with NYC Content

In 1990, Utility Plastics Corporation of Brooklyn received a $400,000 start-up loan from the State Urban Development Corporation, and another $500,000 from the Empire State Development Corporation to develop a facility that would transform recycled plastic bottles into traffic cones and police barricades. The plant was completed for a total of $3.6 million, $1 million of which came from the primary shareholder, Brooklyn Union Gas. At the time, the idea of using recycled plastic from New York City residents to make products for City procurement looked like a promising avenue for recycling economic development. The media and the community received the facility enthusiastically:

> …the Chairman of Brooklyn Union Gas Co. is betting his company's money on a new manufacturing venture that could put more than 100 people back to work in the drug-ridden East New York section of Brooklyn. The company is perhaps one whose time has come.…Sales could eventually reach $2.5 million. More important than the size of this venture, however, is its significance to Brooklyn and the

> rest of the city. New York has lost 161,000 manufacturing jobs in the last decade. This is a small step toward reversing that trend.[68]

The facility planned to sell its product to Con Ed, Brooklyn Union Gas, New York Telephone, the Port Authority, and City and State Departments of Transportation. It would accept recycled plastics from DSNY, as well as other towns in the region, and expected to manufacture its products at "costs way below those of other traffic cone manufacturers, many of whom would use more expensive virgin plastic."[69]

Maintaining low material costs was essential because, the article pointed out, "labor costs will be significantly higher than those of competitors, who don't need the manpower to sort what comes in."[70] The wages the plant would generate were seen as a social, as well as economic, benefit to the area, and the venture was portrayed as a "win-win project for everybody involved."[71] (Photo 2-16)

Only two years later, Utility Plastics was struggling to stay afloat. *Crain's New York Business*, which had reported extensively on its promise in 1990, now observed that, "despite the great fanfare surrounding its launch, the

Photo 2-16

In the early 1990s, the Utility Plastics Corporation of Brooklyn recycled plastic bottles into traffic cones and police barricades.

Brooklyn company has had little success selling its plastic traffic cones and police barricades to its prime targets—state and city agencies."[72] This failure was attributed to both market forces and marketing strategies:

> The plight of Utility Plastics shows just how hard it is to sell products in the depressed market for recycled materials. The company has run into trouble rounding up enough customers even though its cones and barricades have earned favorable reviews.…The company's woes show how risky it can be for businesses to depend on state and city procurement guidelines, no matter how well-intentioned.…Public officials have steered minimal business to the company so far.[73]

The reason for shortfall in public procurement demand was, according to the company's CEO, the fact that "to purchase our products, they [public agencies] have to revamp their systems…[We] couldn't generate much business from city and state purchasing agents seeking the lowest bidder."[74] These problems were compounded by a slump in the plastics markets, which made products from elsewhere (both virgin and recycled) cost-competitive with the homegrown cones. Ultimately, the company vision of supplying city agencies with products made using DSNY-collected recyclables did not materialize.

There were a few other efforts to promote City agency use of recycled plastic materials. In 1993, a Parks Conservancy project contracted with Santana Products of Scranton, Pennsylvania to supply bathroom partitions and park benches with a specified content of NYC plastic. In 1995, there was a flurry of attention to the Department of Citywide Administrative Services' (then known as the Department of General Services) purchase of plastic lumber for a pier project at Tiffany Street in the Bronx. The lumber, made of "the recycled extract of two-liter plastic soda bottles,"[75] totaled 607 tons for the pier, and had the benefit of being impervious to the marine organisms that degrade wood piers (although not to lightning, which melted the pier when it struck it some months later).

None of these promising initiatives, however, was able to create a sustained end-use for the tons of plastics moving through the DSNY waste streams each day. As the 1993 NYU report had observed, "many firms that…recycle HDPE and LDPE…have had considerable difficulty delivering their product at prices and in volumes that make it competitive with virgin resins."[76] The reluctance of City agencies to purchase locally produced, recycled-content materials when they were more expensive than alternatives stemmed partly from the priority of State law requiring government agencies to accept lowest bids in awarding contracts.[77] While numerous City initiatives have attempted to incorporate preferences to mitigate the lowest cost imperative (such as provisions for minority- and women-owned businesses), such preferences have routinely been challenged through legal means by private firms seeking to bid on municipal contracts. The problems also stemmed from expecting more flexibility and preference than the massive, bureaucratized procurement system in the City would provide.

A Mill for Recycled Paper in New York City

During the 1990s, the NRDC, in partnership with other organizations, struggled to begin a project to build a paper mill in the Bronx that would take NYC's recycled paper and turn it into newsprint, which it would sell to local newspaper publishers. The saga of this decade-long struggle is complex, but ultimately, no such mill was built.[78] As one journalist put it, "paper companies and developers seemed close to building at several points, but ultimately no one was willing to put up the money. After eight years, the project was formally abandoned…Investors decided the returns from the mill would not be enough."[79] In 2000, the NRDC's Allen Hershkowitz attributed investor withdrawal from the project on "the high tech market, the fact that so many

people were getting very high returns on stocks and high tech when we were going to financing."[80] It seemed that there would always be a small window of investment opportunity for a start-up firm, especially a large one, in a constantly fluctuating market.

In contrast to the Bronx project, the development of a private paper-recycling plant and board mill on Staten Island was a rapid success. Work on the project started in 1995, under the leadership of the NYC EDC, when the City began the process of convincing the Australian Company, Visy Paper, a subsidiary of Pratt Industries, to locate a mill on Staten Island that would take New York's recycled paper and use it to produce linerboard (Photo 2-17). The company was initially considering locating at sites in Pennsylvania and New Jersey, but was persuaded to build in Staten Island by a package of inducements. These included over $50 million in abatements from city and state sources on real estate and other taxes, as well as a construction labor agreement with Building and Construction Trades Council that included a no-strike pledge and reduced overtime agreement, and a reduced electricity rate from Con Edison.

The project received loans from several sources, among them the NYC Industrial Development Agency, which floated solid-waste bonds to finance the project. New York State directed a total $1.4 million into the project, with $1 million from the New York State Department of Transportation for roadway improvements and $400,000 in grants and loans from the Empire State Development Corporation.[81]

The bureaucratic aspects of project development were streamlined by awarding the contract without competitive bidding, and enabling fast-track environmental permit approvals.[82] DSNY committed to delivering between 30 to 50 percent of the City's residential wastepaper to Visy each year, using the existing, City-owned MTS (marine transfer system), in an agreement that entailed revenue sharing and no net processing fee to the City.

The facility, which cost roughly $250 million, was projected in the late 1990s to have a capacity of 250,000 tpd and create up to 300 manufacturing jobs. In total, it was estimated that the construction phase of the project would generate $16.2 million in taxes and $495 million in overall economic activity alone. Once operating, the facility would generate annual taxes of roughly $2.6 million, and an annual direct and indirect economic activity of $107.2 million. The facility, which had the joint support of Borough President Molinari, Governor Pataki, and Mayor Giuliani was built in less than one year, and today is the City's largest contractor for paper.

Photo 2-17

Now formally known as Pratt Industries, but still referred to as Visy Paper, this plant processes 150,000 tons of recycled New York City paper each year; around half of the City's total recycled-paper waste stream.

Developing Private Processing Capacity: What Happened Instead

The exploration of ideas that went on between 1992 and 1993, and the flurry of planning that followed in 1994, was expected to lead to the development of a varied, high-technology recycling industry in New York City, representing a range of public and private facilities, and including both processors and recycled-input manufacturers. Ultimately, this did not happen.

Here and there, small ventures did appear that would make innovative products out of certain discards, but these factories generally used cleaner and purer commercial waste streams, and operated on very small scales. Firms specializing in glass tile manufacture, plastic pelletizing, and other niche products found that they could not use the large quantities of DSNY recycling, nor could they handle the mixture of materials and contamination that came along with it.

By the end of the decade, only one venture successfully emerged to respond to DSNY's voluminous, mixed-recyclables stream—Visy Paper of Staten Island. Despite millions of dollars in State funding of recycling economic development in New York City, other projects of this period, both public and private, failed to create primary capacity for residential recyclables. Nevertheless, New York never stopped needing to move its collected recycling up and out of the City each day. With public MRFs off the table, and other projects in only developmental stages, the only viable candidates for this job turned out to be local recycling processors.

Private MRFs

Who were these local processors with whom the City contracted to handle its recyclables? In general, they were enterprises owned and operated by established waste-hauling firms in the New York area, some of whom had been active in commercial refuse carting for decades. These firms responded to the short-term contracts issued by the City in an economically rational manner, for example, by supplying no major up-front investments in new sites, large plants, or high technology.

MGP processors set up sort operations on existing property already permitted for waste handling. They installed basic automatic sorting equipment—such as magnets and eddy currents for metals separation, and trommel screens to sift out broken cullet and fines—but did much of the processing manually. None engaged in remanufacturing. Instead, their profits from recycling depended solely on selling sorted and baled recyclables from both residential and commercial sectors on an open, secondary materials market (Photo 2-18). This market included brokers and manufacturers across the nation and throughout the world. In addition, these firms were actively pursuing other avenues of profit in collection, transfer, and disposal services for commercial generators.

Throughout the 1990s, the City forged a series of contracts with an array of local processors. DSNY began with short-term contracts in 1989, renewable on a yearly basis. In 1992, with some experience under its belt, the City bid out longer-term agreements. In some cases, the same firm bid for both paper and MGP (processed in different areas of the facility); in others, a firm specialized in one of the materials. By the end of these contracts in 2002, processing costs averaged about $59 per ton. Meanwhile, two related outside political events of the 1990s altered the corporate identity of processors in NYC—the prosecution of organized crime elements in the local carting industry, and the entrance of several multinational "waste giants" into the New York market. As the 1990s progressed, the waste industry in the City and surrounding areas, as in the rest of the country, saw numerous mergers and acquisitions of smaller firms by larger ones.

Yet the basic nature of the NYC processing operations, and in most cases their location and capacity, remained unchanged. The reason for this was the financial constraints these firms still faced. Industry consolidation had resulted in unionization of the sorting work force, and consequently, higher labor costs. At the same time, the increase in diversion throughout the late 1990s strained operating capacities once considered ample for NYC recycling. Because processors had been contractually bound to accept material 24 hours per day, six days per week, they were not able to carry out major facility improvements. To make matters more challenging, NYC Contract Rules enabling the City to opt out of agreements with only ten days' notice had discouraged processors from investing in new facilities. These realities meant that even the arrival of large waste corporations like Waste Management or BFI in New York in the mid-1990s did not herald new, more efficient, larger capacity MRFs—it simply meant the same modest MRFs with new owners.

The Need For Reliability

This is not to say that parties with ideas for new processing technology, or interesting recycled-content products, were silent during the 1990s. Over the years, DSNY met with many entrepreneurs, some from as far away as Asia, who proposed to come to New York with a variety of ways to turn "garbage into gold." Yet the City was constrained in its contracting choices by some very basic realities having to do with the waste stream.

Photo 2-18

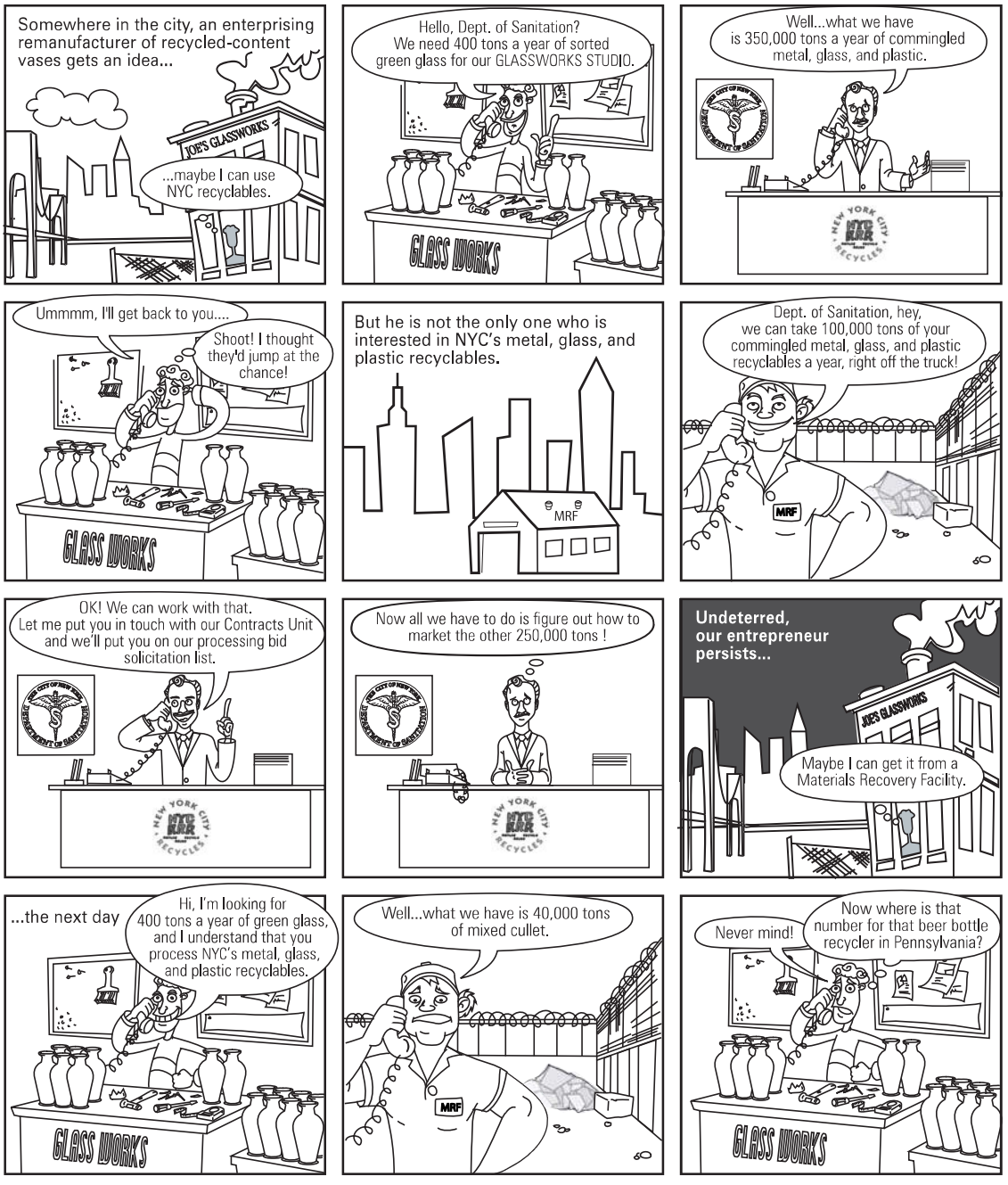
The MPG processors contracted with the City used automated sorting for metals, but relied on manual sorting for other materials. Most of their profits came from selling sorted and baled recyclables.

First and foremost was the need for reliability. With collected tonnages of recyclables increasing from about 600 tpd in 1992 to over 2400 tpd by 2000, the City simply had to contract with firms of a size and capacity capable of taking large tonnages day in and day out, no matter what crisis came along or how tough the market became. Moreover, their technology had to be proven—not just in the laboratory or with clean streams of commercial recycling (as many enthusiastic entrepreneurs proposed)—but in the field with commingled, residential materials.

Furthermore, firms specializing in recycled-content manufacture had to be partnered with reliable processors who could deliver sorted, cleaned, and baled materials to them at a cost that would enable them to stay in

business. It was not enough, for example, for an entrepreneur to say, "I have a great idea for manufacturing glass vases, and I can handle a lot of the City's residential glass if it comes my way"[83] (see Figure 2-2). For such an idea to work, the entrepreneur would need to work out how to get the sorted glass out of the commingled MGP that the Department was collecting from residents—as it was at the time, not under an optimal scenario of no contamination or no glass breakage. And it would be necessary to think about the economics of where the sorted plastic and metal would go once the glass was removed—which would mean

Figure 2-2
Cartoon of Exchange Between Potential Users and Processors of NYC Recyclables
A little humor to illustrate a point



either widely expanding the entrepreneur's scope of operations, or partnering with one or more recycling businesses who would need to show similar preparedness. Finally, the entrepreneur would have to know that the manufacturing process he or she planned to use would be viable with NYC residential glass, and that the resulting product would sell to someone, somewhere.

In sum, although in many cases entrepreneurs stated that they would take NYC's recycling, they wanted it in a form far different from what was collected. To satisfy one processor's supply requirements would have meant changing everything about the recycling program: public education, sorting requirements, collection methods—all for only a portion of the total recyclables mix. This rendered such proposals unviable not just to DSNY, but to functioning recycling in New York City.

While the Department remained open to new ideas, and was active in putting manufacturers in contact with processors to develop them, its primary responsibility was to keep the flow of residential recycling moving. Thus its contracts required firms to prove their ability to (1) accept daily deliveries of specified tonnages of recyclables; (2) actually market the recyclables for beneficial use; and (3) maintain detailed records on tonnages delivered, tonnages marketed, revenue from sale of materials, and bases for any charges made to the Department for processing. Firms able to do this in the 1990s, with the exception of Visy Paper, were local waste-management firms.

High Processing Costs

The revenues that could be expected from residential recycling were constrained by various factors. Because of paper's generally strong market value, starting in 1996 contracts for processing of commingled newspaper, mixed paper, and cardboard were able to require a floor price to be paid to the City regardless of market conditions, with further provisions for revenue sharing when prices rose above a certain level. But because of market weakness for glass, as well as the higher processing costs entailed with sorting commingled materials, the MGP contracts could not guarantee a floor price to be paid to DSNY. Instead, in most years, the Department ended up paying for MGP processing, with revenue sharing only offsetting costs. (See Table 2-3, pages 72–73, for a chronology of how recyclables have been processed in NYC.)

Initially, the City paid processors a flat fee to accept, process, and market commingled metal, glass, and plastic. Later, MGP contracts incorporated provisions that allowed for a reduction in this fee when markets were doing well. Over and above these basics, the contracts included provisions which: (1) allowed the City to assess liquidated damages against vendors who failed to accept loads or otherwise failed to follow through on agreed upon terms; (2) made allowances for severe weather; and (3) prepared contractors to expect and plan for certain percentages of resident contamination.[84]

When the Department's five-year MGP contracts expired in June 2002, bids to accept and process the commingled MGP unexpectedly came in between $95 and $165 per ton, far more than costs under the previous contracts. Bidders justified this escalation on the basis of labor and transportation costs they faced, which were considerably higher (in real dollars) than they had been in 1994. Bidders also sought an immediate infusion of cash to make infrastructural improvements, which were precluded by the six-day, 24-hour operation requirements, and short-term nature of prior contracts.

Bidders also cited a higher processing fee to cover costs associated with handling mixed cullet in the MGP stream. Depending on the sort techniques in use at each MRF, mixed cullet comprised as much as 40 percent

Table 2-3
Processing Chronology for NYC Recyclables

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994
Tons of Paper/MGP diverted per day*	N/A	N/A	N/A	Data not available			634	863	1,530
Paper-processing arrangements	DSNY relies on paper brokers who bid periodically to take collected tonnages. The City pays roughly $27 per ton for processors/brokers to accept its paper.						DSNY enters into annual contracts with brokers, who market paper inside and outside NYC. Payment arrangements fluctuate between revenue (where the City is paid) and expense (where the City pays for processing), depending on market conditions. In November 1994, paper contract index revised to better reflect market conditions and increase DSNY's share of revenue.		
MGP-processing arrangements	MGP is not yet collected.			MGP collected and processed under pilot program. Processing is done by private contractors in Long Island and New Jersey for a flat fee of $40 to $60 per ton.		Some of the City's MGP is processed in DSNY's pilot Intermediate Processing Center (IPC). Average cost is $175 per ton.	The same private contractors continue to process the remainder of the City's MGP under short-term contracts that charge a flat fee for processing. DSNY solicits bids for longer term MGP-processing contracts.		
Major events	Pilot newspaper recycling collection implemented in many of the City's 50 community districts.			Recycling law passed.	Mandatory paper- and MGP-recycling program begins.	Borough-wide collection of designated recyclables phased in for all three-million City households and 5,000+ public institutions.		Crackdown on organized crime in NYC waste-hauling industry. As a result, contracts with several paper and MGP processors are terminated.	

* Diversion tonnages are for the fiscal year and represent daily averages.

Table 2-3
Processing Chronology for NYC Recyclables, continued

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1,522	1,505	1,615	1,946	2,224	2,411	2,450	2,442	1,427	Data not yet available

DSNY sells two-thirds of its paper to brokers, with five-year contracts fluctuating between revenue and expense, depending on market conditions. The remaining one-third is sold to Visy Paper, with a provision that the City will always be paid a minimum floor price of $10 per ton for paper, regardless of bad markets, and will gain modest revenue when markets are good.

DSNY reduces the share of paper sold to brokers to approximately one-half, and solicits five-year contracts with three additional five-year renewal options with floor prices (minimum payment per ton to DSNY). This ensures that DSNY will never pay for processing, and will share revenue when markets are strong. A 20-year contract is set with Visy, who receives approximately the other half of the City's paper. There is now no processing cost to the City to recycle paper, and there are favorable arrangements for revenue sharing during good economic times.

DSNY enters into longer term expense contracts with a number of private processors (most in NYC). Average cost is $55 per ton. Contracts involve straight tip fees without indexing. Through mutual agreement in 1994, contracts are renegotiated to include an index to track the market. Costs are reduced by revenue sharing when markets are good. Contracts are for an initial five-year period, extended by four one-year renewals. By the end of these contracts, DSNY is paying processors around $59 per ton.

In June 2002, MGP contracts come up for rebid; processors bid between $95 and $165 per ton. As a result, plastic and glass recycling is suspended and household metal is processed through an existing scrap metal recycling contract, whereby the City receives $30 per ton. DSNY solicits new bids to process MP and MGP. Scrap-metal processor bids to pay the City $5.10 per ton for MP and charges $70, later reduced to $50 to process MGP. (Other bids charge around $90 for MP and $127 for MGP.) When plastics recycling resumes in July 2003, MP is processed via an interim contract with scrap-metal processor who pays $5.10 per ton. DSNY issues RFP in August 2003 for long-term MGP processing, which includes revenue-sharing provisions. When glass recycling returns in April 2004, MGP is processed through an interim contract with metal-scrap processor who charges $50 per ton.

Expanded recycling phased in citywide.

Weekly recycling collection implemented.

Fresh Kills closes.

Glass and plastics recycling suspended.

Plastics recycling reinstated; alternate-week collection of recyclables.

Glass recycling reinstated; weekly collection reinstated.

City begins to develop and implement paper mill project with Visy Paper.

DOT stops accepting DNSY's glass for "glassphalt" production.

World Trade Center tragedy

Ongoing NYC fiscal crisis

Metal and concrete debris from WTC is processed at Fresh Kills; much metal is recycled.

NYC paying nearly $100 per ton for refuse export.

National and international waste industry consolidates.

of what was processed (Photo 2-19). As of 1997, this cullet was no longer accepted by the NYC Department of Transportation, for reasons described earlier. According to the processors, the costs of transporting this material to sites for alternate beneficial use as roadbed material or, in some cases, daily cover at landfills, justified the increased bids. Processors also cited costs associated with contamination of commingled MGP with non-designated plastics and organics.

Photo 2-19

Mixed cullet, a zero-value commodity, accumulated in stockpiles as shown here, and comprised as much as 40 percent of what was processed at MRFs.

Like any business, the processors contracting with the City had opted for a mix of technology, labor, and capital investment that would, over the period 1994 to 2002, yield the greatest profit for the least cost. This mix was calculated based on the processing fee they could charge the City, as well as the state of glass, plastic, and metals markets. And, in some cases, it was balanced against investment in other activities like processing commercial materials or refuse handling. When contract renewal came up in June 2002, these firms could not make the numbers work out without raising the processing fee.

Onset of a Crisis

This turn of events came just after the 9/11 World Trade Center tragedy in New York City in 2001, which compounded the local effects of an already mounting economic downturn nationwide. All agencies were called up on by the Mayor to cut wherever possible. Due to the potentially very high cost of MGP processing the City was facing, canceling glass and plastics collection seemed an obvious way to quickly reduce budget outlays. In June of 2002, the City Council passed Local Law 11, which suspended glass and plastic from the recycling program for one year, but directed the reinstatement of plastic one year later, and glass in 2004. Contracts with MRFs were not renewed for MGP processing.

Instead, DSNY entered into an arrangement with a scrap-metal processor, Hugo Neu Schnitzer East, already under contract to the City to receive scrap metal. The company operated three sites in and around the five boroughs (Photo 2-20). Using this existing contract, the firm would accept and process residential household and bulk metal, and would pay the City a minimum of $30 for each ton. The glass and plastic that had formerly been collected for recycling was now collected and exported along with the rest of the City's refuse.

In late 2002, the City consequently rebid interim processing contracts for metal, plastic, and beverage cartons (MP) and MGP processing to meet the tight schedule for reinstatement of plastic and glass recycling set forth in Local Law 11. Nine qualified bidders, including Hugo Neu Schnitzer East, responded this time. Eight of the nine bid per-ton processing costs that ranged from $70 to $110 for MP and $83 to $172 for MGP. Hugo Neu Schnitzer East, by contrast, offered a positive floor price of $5.10 per ton for MP. That is, it offered to pay NYC

that much for each ton of commingled metal, plastic, and beverage-carton recyclables that were delivered. And its processing cost for MGP was lower than those proposed by the other firms: $70 per ton. Several months later, Hugo Neu Schnitzer East voluntarily reduced its bid for future MGP processing to $50 per ton as it assumed responsibility for processing all of the City's MP at its three sites in the New York area, paying the City $5.10 per ton.

Photo 2-20

When the City suspended glass and plastics recycling in July 2002, it continued to recycle metal through a scrap metal processor. DSNY trucks delivered household and bulk metal collected from residents to one of three sites operated by Hugo Neu Schnitzer East.

In July 2003, plastic was reintroduced to the recycling program, and in April 2004 glass was added back. In the meantime, DSNY issued an RFP for a longer MGP-processing contract designed to avoid some of the problems with capacity and market volatility experienced since the beginning of the recycling program. It had become clear that the answer to the problems with recycling was not, primarily, the need for local economic development of remanufacturing capacity that had been the focus of so much attention in the early 1990s. Rather, the focus of the new, longer term contract was to secure a firm with: (1) large-scale, primary processing capacity; (2) an ability to market materials regionally, nationally, and internationally; and (3) a disincentive to dispose of materials as residue.

The Lessons of History

In 1992, Sanitation Commissioner Lloyd likened recycling to "mining or foresting," saying, "We're culling a resource from all this material and in the process replacing jobs lost in the manufacturing sector."[85] Since then, history has shown that recycling is *not* like mining or foresting. Recycling is an unusual meeting of the consequences of individual consumption and the needs of industrial production. It is a field in which the line between public and private sector is constantly under negotiation. And it is an enterprise that is expected to respond to sometimes conflicting economic, environmental, and/or social goals simultaneously.

Adjusting Expectations about Local Economic Development and Recycling

Despite this history, in 2003 there continued to be an expectation among some in the waste-policy community that much, if not all, of New York City's residential recyclables stream could be profitably remanufactured locally into new products, revitalizing New York's industrial economy while creating a cost-effective outlet for processed materials. For instance, in 2001, the Consumers Union, a nonprofit group active in NYC waste policy, advocated that:

> Much more could be done to attract manufacturers that use recycled materials and to assist small businesses in this field. Unlike Visy Paper, many remanufacturing businesses are small, some with

> great ideas that need to be tried on a small scale first. In order to effect change we must change economic development assistance so that it assists small business.[86]

Such initiatives may help local businesses, and may even create badly needed manufacturing jobs in New York City, but they will not address the economic efficiency of recycling the materials that New Yorkers generate. Most remanufacturers of recycled products need a clean supply of materials, but do not necessarily require large volumes, especially if they are the type of small enterprise that thrives in an environment like New York. Thus their input requirements (as demonstrated earlier in the cartoon in Figure 2-2, page 70) will frequently be at odds with what the recycling citizens "supply." Yet this does not change the fact that DSNY has a public mandate to collect and move along large quantities of recyclables, whatever their composition. To the Department, as to the public, recyclables are not a "supply" of inputs to production, they are the consequence of personal consumption. Unlike suppliers of other raw materials, consumers do not respond in quantity or material composition to producers' needs.

This means that any remanufacturer seeking to use NYC residential recyclables will have to face the reality of NYC's residential feedstock. Even under the most optimistic scenarios in which residents carefully source-segregate recycling and refrain from contaminating their sorts—residential recyclables will underperform alternative secondary sources. Presorted streams of recyclables from businesses, scrap from other industrial processes, and even reclaimed containers from deposit programs will be vastly more efficient to use in manufacturing.

While this does not absolutely preclude the development of small-scale manufacturers that make goods out of NYC's residential recyclables, it is far more likely that NYC-based remanufacturers will turn to other sources for their secondary inputs; and that NYC's residential MGP, after local processing, will be marketed outside City limits. Although the 1993 NYU study (discussed earlier) identified niche markets as the "best hope" for the development of the recycling industry in NYC rather than "major end-use manufacturing,"[87] it also noted that "by far the greatest number of firms and workers engaged in recycling-related business in New York are those involved in the collection, sorting, and consolidation of recyclable materials."[88] Given the inherent tensions discussed, this is not surprising. But it suggests that the vision of thousands of new manufacturing jobs at hundreds of vibrant new firms is not going to be realized from the diversion of New Yorkers' residential materials.

Visy Paper—which is both a processor and a remanufacturer—has been a notable exception to this trend, but it is the exception that proves the rule. In Visy's case, a multimillion-dollar package of loans, tax incentives, and concessions from the City, the State, a utility company, and a labor union actually succeeded in getting a firm that used NYC recyclables to make commodities *within NYC.* But while Visy benefitted from a broad and ample package of subsidies and concessions, this was not the only reason it came to New York, and stayed. Unlike other ventures that failed in NYC, Visy did not have to secure investment from a coalition of private developers—it was an established concern with intentions to open a mill in the Northeast anyway. The incentives it received from the City and State can be said to have encouraged it to choose NYC over other locales, rather than helping it establish a business in the first place.

Most important, Visy was capable of transforming a less-than-clean, mixed stream of recyclables into a useable product. The liner board it manufactures is made from an undifferentiated mix of newsprint, magazines, catalogs, white office paper, cardboard, and junk mail. New York City's collection arrangements, and an overall three-percent contamination rate for recycled paper, meant that this stream would be delivered to Visy's door essentially ready to go through the mill. Any remanufacturing venture that hoped to use NYC's residential MGP to make new products would have to be similarly equipped.

Unfortunately, these facts have not been taken into account in waste-policy advocacy in New York City, even in 2004. The return of recycling was predicated on the City's securing a long-term, cost-effective relationship with a primary processor. Nonetheless, there continues to be expectations that the way to ensure that processed residential materials are "sold for the highest value in the marketplace" is through "attracting new recycling-related industries and businesses to the city."[89] A recently released report by a coalition of environmental, consumer, and community groups, and led by NRDC, once again recommends "financing to companies…through tax incentives, loans, and grants, as well as help [to] these businesses to navigate the permitting and construction processes."[90] No matter how well intentioned such recommendations are, they still assume that local assistance to small processors or remanufacturers will affect demand for NYC's processed recyclables—and, as this chapter has extensively argued, such an assumption is just not reasonable.

It is interesting to note that the NRDC Report supports this argument with information about a regional authority (METRO) in Oregon that spans the City of Portland and 23 other municipalities, three counties, and has an area of nearly 600 square miles. The NRDC Report notes that this regional authority "provides grants and loans to businesses that make products with recyclable materials recovered in the region," although it provides no data on how much of Portland or other METRO region municipalities' residential materials are processed regionally as opposed to at other scales. In fact, it is much more likely that the pairing of supply and demand for processed recyclables will take place on a regional level, where materials can move across what have been termed "wastesheds," or areas in which they can circulate as (somewhat) free commodities. It is telling that the NRDC Report fails to mention that no large city—even in California where regionally based recycling economic-development projects are the most advanced—consumes and remanufactures its own residential recyclables within its own municipal boundaries.[91]

Recognizing the Limits to "Buying Recycled"

New York City agencies spend $7 billion annually on goods and services. A portion of these goods could, in theory, be fabricated using recycled content. Over the past decade, there have been continued and frequent calls for the City to mobilize its massive purchasing power and "buy recycled." The expectation has been that if the City purchased such goods, it would build markets for remanufacturers in New York City, thereby aiding processors of collected recyclables, and, ultimately, improving the City's processing contract options.

Yet it stands to reason that if local economic development gains are expected to flow from local agency procurement of recycled content goods, the goods in question must be manufactured locally, out of local content. This condition significantly narrows the potential field of impact that any NYC agency "buy recycled" campaign could have. Given the difficulties that firms manufacturing finished products from recyclables face in New York City, the selection of recycled-content products made in NYC and/or out of NYC residential recycling is meager. The City is then left with some very weak options. It can buy products made outside the City that contain materials from MRFs that accept NYC recyclables. Or, it can commit to paying artificially high prices for a few locally made supplies—some of which may not meet specifications in the best manner.

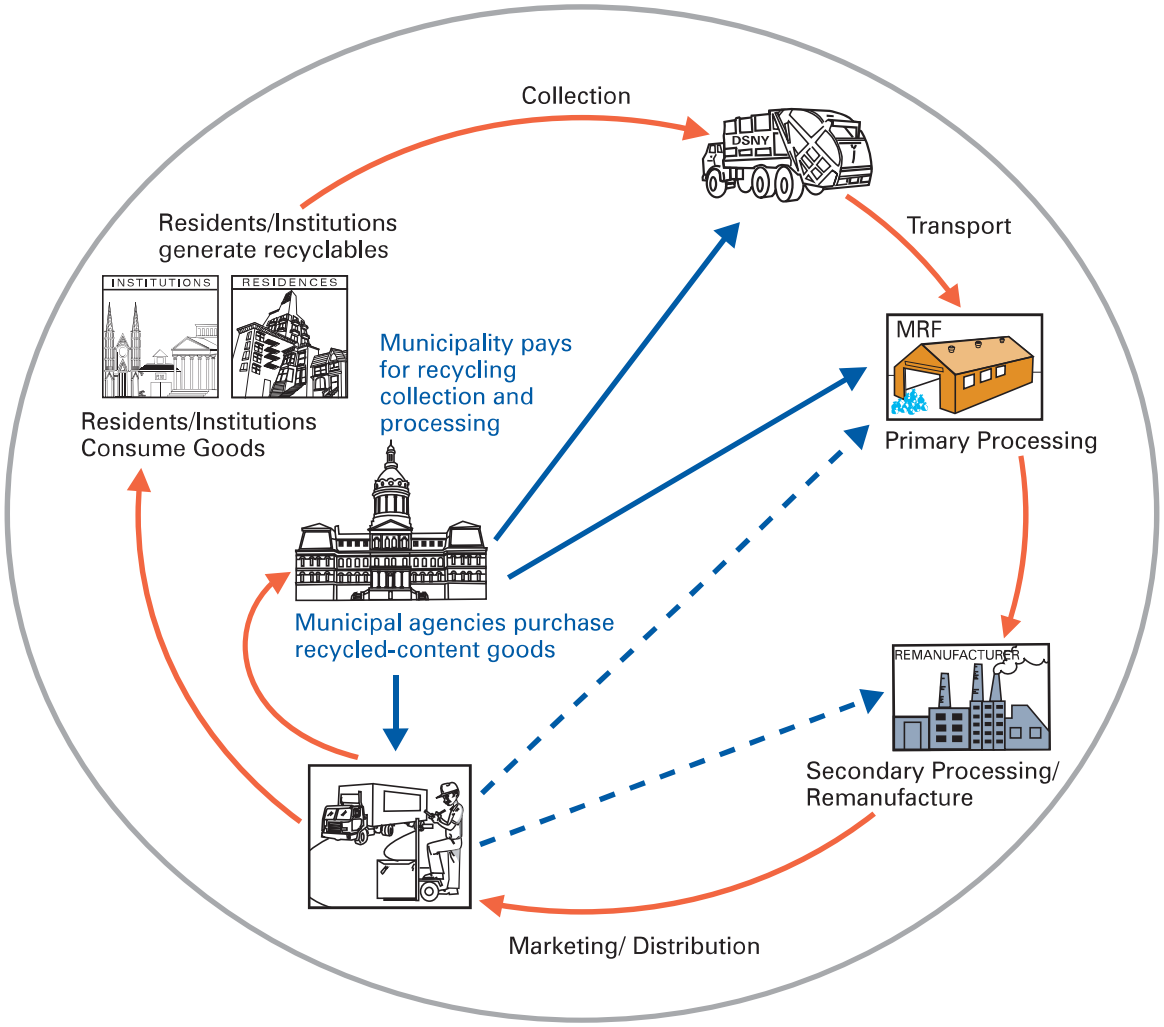
This dilemma becomes particularly pressing when City agency purchasing and contracting is subject to competing demands for economy and accountability by the public and oversight agencies. New York City's Procurement Policy Board, for example, has consistently criticized the use of local preferences in purchasing.[92] Other fiscal conservatives have called for an end to City contract guidelines that respond to human rights and environmental issues abroad. They argue that the City should act more like a business, and less like a social engineer, when buying products. The potential impact of the City's purchasing power on local recycling

economic development becomes even more constrained under such pressures. And the probability of a local recycling industry responding to City agency demand becomes very tenuous.

Yet often these contradictions have been overlooked. It has been easier to assume that City purchasing will "somehow" stimulate the local recycling industry. The link between purchasing and local economic development ends up overstated and underexamined, as depicted in Figure 2-3. Under such circumstances, it is not hard to see why so many initiatives in this regard have stalled. And it suggests that the future of processing and marketing NYC recyclables has to be considered quite separately from any initiative to require agencies to "buy recycled."

Figure 2-3A
Municipal Agency Procurement: The Ideal

In the ideal world, municipal procurement is supposed to stimulate local markets for recyclables. But this depends on municipal agencies buying recycled-content products manufactured within the municipality and made out of the municipality's recyclables.

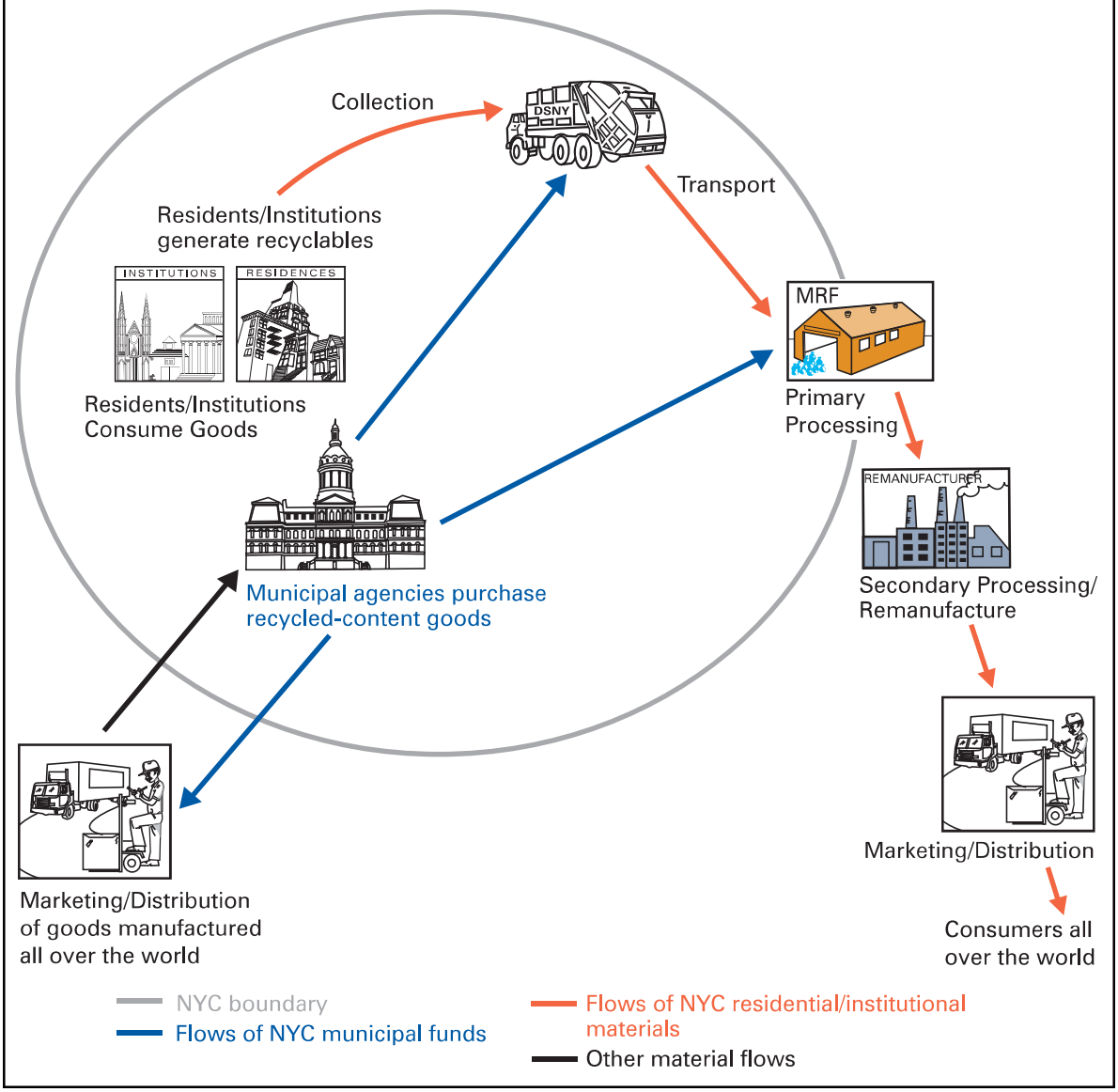


There is ample evidence that recycled materials need a larger scale, or "wasteshed," than the municipality to circulate efficiently.[93] Nonetheless, there is continued advocacy for NYC agencies to "buy recycled" as means of "Making New York City's Recycling Program More Effective" (the title of NRDC's recent report). This Report argues that what is needed to improve the NYC Recycling Program is "new legislation that would require city agencies to purchase paper and other designated products with minimum levels of post-consumer recycled content, especially products that use recycled glass or plastic."[94]

There is no doubt that requiring City agencies to "buy recycled" would provide symbolic support for recycling in general. Such a requirement might or might not save agencies money, but it would certainly make a small

Figure 2-3B
Municipal Agency Procurement: The Reality

In reality, recyclables generated within the municipality are marketed outside municipal borders. Municipal agencies also buy recycled-content products that come from outside the municipality.



contribution to the national market for recycled-content goods. Yet passing such a law would not improve markets for NYC's recyclables, for reasons explained already. To do that would require an elaborate legislative-administrative effort on a scale heretofore never seen in U.S. cities. This effort would have to be mobilized such that remanufacturer supply and agency demand met within city limits on a level that would be economically meaningful for both. Given that agencies procure based on competitive bidding and firms market what they can profitably produce to buyers far and wide, such an effort would be at best extremely difficult, at worst redundant given the existence of much-better-functioning regional, national, and global markets for products that characterize the economy today.

Maximizing the Benefits of Privatized Processing

As late as 1994, DSNY still hoped to develop public MRF capacity throughout the five boroughs. The development of public facilities would not only provide "healthy competition" to private MRFs, but would "combine the benefits of public control and private expertise," since the MRFs would be built and operated by private contractors.[95]

But private recyclers organized and actively fought against the idea of building any public MRFs. Political analysts of the time saw these events as part of a "growing debate over privatization of city services, as well as continuing controversy over recycling policy."[96] In their view, the case for privatization of a range of public amenities was mounting nationwide, and in fact, the trend has been towards smaller local government since then.

The decision to abandon the Staten Island MRF project was linked to the controversy at the time over Staten Island secession and that borough's intense opposition to the Fresh Kills landfill. But the City's overall shift away from direct involvement in processing reflected expectations about efficiency and cost-savings that, it was argued, only the private sector could deliver. What this line of reasoning failed to take into account was that other market forces would limit the range of private options that would ultimately flourish.

Some of these limits—in terms of ability to handle recycled feedstock and to survive strict regulatory conditions—were detailed earlier. Moreover, the private sector was hampered by continued factionalism among trade groups. Private recyclers had hoped to benefit from State and City funding earmarked for economic development. But in 1995, a real estate boom was in the making, and the real estate industry began pressuring Mayor Giuliani to direct tax-exempt financing for housing instead of environmentally oriented industrial projects.[97] New York State capped the City's borrowing authority for 1995 at $122 million, $120 of which was set aside for Visy, with a second $120 million planned for 1997. Access to the remaining funds would be hard for other recycling industries to demand.

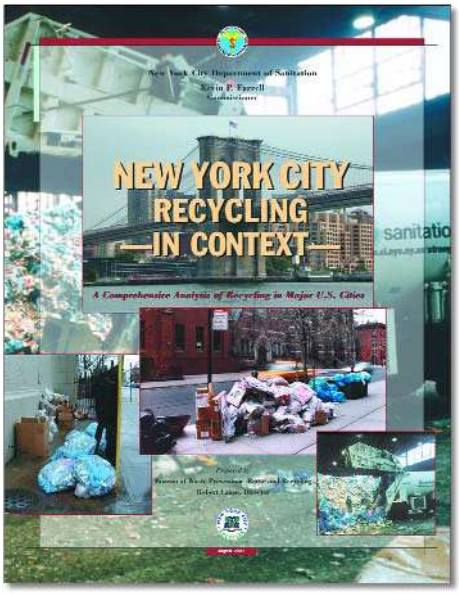
All the while, the national waste industry was consolidating, with several multinational corporations emerging as dominant players in the competition to process recyclables. These firms held two of the MGP-processing contracts with the City between 1994 and 2002. As mentioned in Chapter 1, the fact that these corporations profited as much from disposing of residue from recyclables processing as they did from selling processed materials for beneficial use further limited the benefits that free and fair competition was supposed to afford.

This history suggests that "privatization" in and of itself does not provide the efficiency or the cost-competitiveness that the City needs in its recyclables-processing contracts. What is needed instead is to channel economic development assistance to private firms that have the capacity, the technology, and the worldwide-marketing ability to extract the most value from NYC's residential recyclables stream, and who, moreover, have a business incentive to minimize residue.

Chapter 3
LESSONS FROM OTHER U.S. CITIES

The previous two chapters provided an economic and historical context for New York City's residential recycling program. This chapter compares New York's program to those in several other major U.S. cities, following up on an earlier effort, *New York City Recycling—In Context* (Graphic 3-1). That 2001 report examined diversion rates in thirty of the largest American cities, investigating what went into calculating them and how comparable they were to New York's own rate.

Graphic 3-1
New York City Recycling—In Context



This chapter takes a more in-depth look at four of those cities—San Francisco, Los Angeles, Chicago, and Seattle—to understand better how recycling works in each of them. The three tables in Appendix VI provide a snapshot of these cities' similarities and differences in terms of demographic characteristics, waste tonnages, and waste-management–program characteristics. Quantitative data for these snapshots has been compiled from a variety of sources, and is current to the most recent year published. Qualitative program descriptions reflect information available on cities' websites and published in trade journals.

But tables only present part of the picture. In fact, when comparing recycling and waste management among cities, an in-depth approach is necessary because a city's set of designated materials, curbside set-out requirements, collection methods and machinery, and MRF technology are linked in complex ways. The relationship between the public and private sector determines how these factors interact, both politically and fiscally. Facets of a city's recycling program have to be considered as part of a whole system, which itself operates within a set of demographic characteristics and markets unique to each municipality.

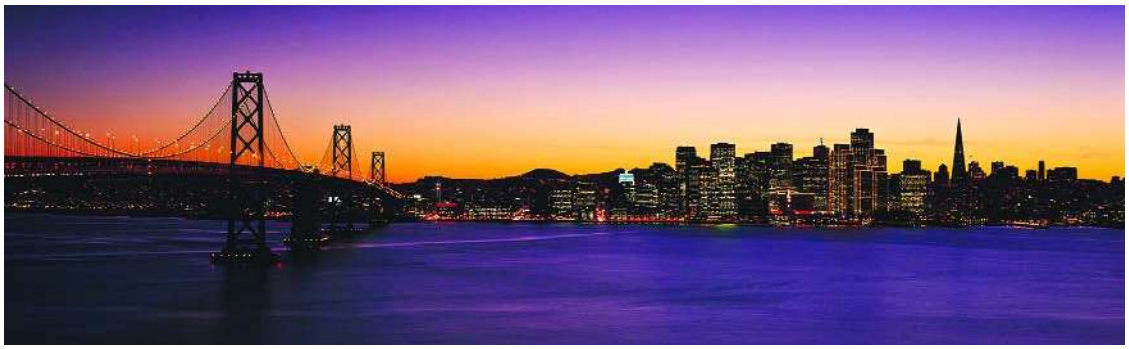
Because the issues are so complex, only four other cites are compared in depth: San Francisco, Los Angeles, Chicago, and Seattle. Their large size, innovative approaches, and high profiles as models for recycling make them good comparisons to New York City. There are, of course, other large, comparable cities (Dallas, Houston, Boston, Philadelphia), as well as smaller jurisdictions known for their creative approaches to recycling and composting (Minneapolis, San Diego, Portland, Toronto—to name a few). But our review of the results of a number of other research projects comparing program characteristics among other U.S. cities suggests that additional comparisons would not have added to the analysis (see Appendix II for further details).

The Case of San Francisco

When it comes to demographic factors that influence recycling, San Francisco (Photo 3-1) may be the most comparable city to New York in the United States. As city officials there observe, "recycling in San Francisco presents unique challenges because of the City's geographic and cultural uniqueness."[1] Many of these features can also be found in NYC, albeit at a larger and more intense scale.

Photo 3-1

Evening sets on the San Francisco skyline.
Demographically, San Francisco is one of the most comparable cities to New York.



While San Francisco's population of nearly 777,000 is a only a tenth of New York's, and its area of around 50 square miles a sixth the size of the five boroughs, the two cities resemble each other in a number of ways (Photo 3-2). There are roughly 17,000 San Franciscans per square mile, a density second in the U.S. only to New York, where 26,000 residents pack into the same area. Both cities have a lot of historic housing—around 71 percent of New York's and 78 percent of San Francisco's residences were built before 1960. And compared to other places, both have far more households in multi-unit housing, though in New York this percentage is greater. In NYC, 63 percent of all housing units are in buildings of five or more units, as compared to 42 percent for San Francisco. In most cities this fraction is lower than 40 percent.

Furthermore, in both cities, dense, old, multi-unit housing means much less yard waste than average. New York City's heavily developed urban landscape yields relatively little in the way of grass clippings, leaves, and other yard organics. Yard waste in San Francisco makes up only a small part of residential discards as well.[2] In comparison, residential discards of grass, leaves, brush, clippings, and other outdoor organics make up 12 percent of waste in residential waste nationwide.[3]

Photo 3-2

Like New York City, San Francisco is densely populated, has a large number of older apartment buildings, and has relatively few yards.

A Privatized System

Despite these similarities, several aspects of residential-waste management in San Francisco are vastly different from New York City. First and foremost is San Francisco's *entirely privatized waste-management system*, for which residents pay monthly fees. Unlike many large, old U.S. cities, sanitation services in San Francisco have been privatized since the 19th century. Today, the same companies that operated nearly 100 years ago—Sunset Scavenger and Golden Gate Disposal—are still in business, although they are now both subsidiaries of Norcal Waste Systems, Inc., a California-based corporation. The City of San Francisco's Department of the Environment oversees Norcal's operations, and intervenes heavily in program design and other corporate policy matters surrounding waste reduction. But the city itself provides no collection or even billing services.

Photo 3-3

San Francisco's privately operated "Fantastic Three" program features a blue bin for commingled paper, metal, glass, and plastic; a green bin for food and yard waste; and a black bin for refuse.

Sunset and Golden Gate offer recycling and, in most areas, green-waste collection along with refuse pickup to San Francisco's 300,000 households under a program called the "Fantastic Three"[4] (Photo 3-3). Homeowners and apartment-building owners pay variable rates according to the size and number of refuse containers they use. Recycling containers—blue for commingled paper, metal, glass, and plastic; and green for food and yard waste—are provided at no extra cost.

Collection and Processing

In the past, San Francisco's residential refuse and commingled paper, metal, glass, and plastic recycling was collected in separate, manual, rear-loading trucks. With the implementation of the Fantastic Three program, collection methods changed. Refuse *and* recycling are now collected in one semiautomated, vertically split, dual-compartment, side-loading compactor truck (Photo 3-4). Households receive a separate organics collection using semiautomated, side-loading, single-compartment compactors.[5] Collection costs average roughly $120 per ton.[6]

Photo 3-4

San Francisco's Norcal collects refuse and recycling in a semiautomated, vertically split, side-loading compactor truck.

Officials at the Department of the Environment note that "replacing four drivers and two trucks with two drivers and two semiautomated trucks and rerouting as the [Fantastic Three] program is rolled out has increased efficiency. However, no layoffs or job losses are projected because

of attrition and new recycling programs and processing."[7] Moreover, "as the program rolls out, route size and configuration are adjusted to address the great variability in density, geography and service levels (e.g. curbside vs. backyard or alley cart collection)…To serve some of the hilly, dense areas of the city…[the Norcal haulers] anticipate testing other vehicles."[8]

Photo 3-5

Paper, metal, glass, and plastic are sorted, separated, and baled at San Francisco's "Recycle Central" MRF.

Another feature affecting costs is the city's use of single-stream collection for recycling. Unlike New Yorkers, San Franciscans recycle paper and metal, glass, and plastic containers in one bin. All materials are brought to the City's MRF, "Recycle Central" (Photo 3-5). Discussions with the operations manager there suggest few problems with the contamination of paper with glass shards (a phenomenon known as "glasspack"), despite the fact that loads are compacted. Recycle Central uses highly efficient sort screens that, when combined with the manual removal of paper early on the sort line, yield a very high-quality, paper end product. Metals are extracted at the MRF using standard magnetic and eddy-current technology, while glass and plastics are manually sorted. The MRF generates PET and mixed-resin bales which find good markets, both in the Pacific Rim and locally. Intact glass containers are manually color-sorted and much glass is sent to a second "glass MRF" or glass beneficiation facility for further, optical color-sorting.

San Francisco's approach to contamination also influences its overall costs. In an effort to maximize recovery of plastics with established markets, the city's program accepts all plastic resins. (Plastics that are not marketable are disposed of as residue.) As a consequence, food and other garbage items in the recycling are the only real sources of contamination. Under the city's voluntary program residents are not required to recycle, so they face no adverse consequences for discarding recyclables with trash. Contamination of recycling, including the willful disposal of trash in a recycling bin, is handled by leaving the full recycling bin at the curb uncollected with a note, possibly followed up by a discussion between the vehicle driver and the homeowner.[9] In its recyclables-composition estimates, San Francisco claims a residue rate of around 5 percent.[10]

The city also achieves economies by composting both yard and food waste. In 2001, Sunset and Golden Gate collected 80,000 tons of organics from San Francisco businesses and households (most came from restaurants and food stores). The organics were delivered to the same transfer station that is used to handle San Francisco refuse, top-loaded into trailers, and trucked 65 miles to Norcal's Jepsen Prairie organics-composting facility in Vacaville, California (Photo 3-6). The

Photo 3-6

Norcal's outdoor composting facility is sited outside the City of San Francisco, in the rural town of Vacaville.

residuals, which consist of yard waste, discarded food, soiled paper, waxed cardboard, and animal bedding, were processed in an Ag-bag in-vessel composter, followed by outdoor windrow curing and a final screen.

Diversion

San Francisco takes a much broader approach to evaluating its diversion accomplishments than does New York City. San Francisco's official recycling rates and tonnages—in the sense of those routinely reported to the public, referenced in the media, and assessed by the State of California—encompass commercial, industrial, and residential sources. Figures on diversion, costs, and waste flows are not normally published by generator type, but are instead evaluated for the City's entire, privately serviced, waste-management system as a whole. The State of California holds municipalities to a 50-percent-diversion mandate, with fines of $10,000 a day for noncompliance. At the same time, it allows many forms of commercial and industrial diversion, including C&D recycling, asphalt recovery, containers redeemed under the state's deposit program, and commercial composting of food waste, to count towards the 50 percent goal.

Diversion Measurement in California and New York—Vastly Different Methodologies

The diversion rate for all municipalities in California is *indirectly measured*. While California municipalities directly measure and report amount of refuse *disposed,* they do not directly measure the amount of waste recycled or otherwise diverted from disposal. Instead, the California Integrated Waste Management Board estimates each jurisdiction's waste generation tonnage using results of a statewide waste characterization conducted in 1999, which is adjusted annually to reflect inflation, taxable sales, employment, and population shifts in that jurisdiction. Diversion is then calculated from this estimate by subtracting the tonnage of waste disposed.

California Diversion Rate:

$$\frac{\text{estimated tonnage of total waste} - \text{directly measured tons of refuse}}{\text{estimated tonnage of total waste}}$$

Any tonnages estimated to have been generated, but not directly measured as disposed, are assumed to have been recycled, composted, reused, or even prevented. Municipalities are not required to report the composition of diverted materials, nor to break down diverted tonnages by their particular method of diversion.[14]

In contrast, the diversion rate in New York City is *directly measured.* Every DSNY recycling or refuse delivery truck passes over a scale, which records the weight of that truck's load on that delivery, minus the weight of the truck itself. This allows DSNY to calculate the total tonnages of recycling and refuse daily, weekly, monthly, and annually. The diversion rate at any time is tonnage of DSNY-collected recycling divided by the tonnage of DSNY-collected recycling plus refuse (total DSNY waste).

NYC Diversion Rate:

$$\frac{\text{directly measured tons of DSNY-collected recycling}}{\text{directly measured tons of DSNY-collected total waste (recycling+refuse)}}$$

Photo 3-7

San Francisco's "Fantastic Three" program is expected to be implemented citywide by 2005.

The City's most recently published diversion data is for 2001, when 46 percent of the San Francisco combined waste stream was recycled. City officials announced that attaining this goal was a "huge increase for one year and puts us in the position to reach 50 percent, certainly by the end of 2003."[11] Much of the City's success, the officials pointed out, was attributable to food waste composting from restaurants and markets, as well as "a major increase in recycling construction and demolition debris."[12] In fact, out of San Francisco's annual combined waste stream of 1.7 million tons, of which 825,000 tons were diverted from disposal in 2001, a total of 584,000 tons, or *more than half the diversion,* consisted of materials other than paper, metal, glass, plastic, or organics—such as C&D material, clean fill, tires, and wood.[13]

Residential Diversion

San Francisco does not publish data on residential recycling tonnages separately from overall tonnages for residential, commercial, and industrial waste combined; but it does report a residential-only diversion rate of 38 percent.[15] An article published in 2000 in *BioCycle* stated that before the introduction of organics collection, residential diversion was 20 percent, or around 60,000 tons of recycled paper, metal, glass, and plastic per year.[16] This means that a full 18 percent of diversion now comes from materials other than metal, glass, plastic, and paper—such as yard waste, construction and demolition debris, textiles, furniture, tires, and bulk.[17]

As previously described, residential recycling is organized under a program called "Fantastic Three," in which residents are provided with a green cart (for food scraps, soiled paper, and yard waste), a blue cart (for commingled paper, metal, glass, and plastics), and a black bin (for refuse) (Photo 3-7). The program, which is currently available to most of the city's households, is expected to be fully implemented citywide by 2005 at the latest.

Surveys show that the Fantastic Three program has been enthusiastically embraced by residents of single-family homes and small complexes.[18] In larger, multi-unit buildings, however, green-waste recycling has met with less of a response (Photo 3-8). Recycling and composting are completely voluntary in San Francisco. While residents of buildings containing five units or less are automatically provided with green-waste containers, under the Fantastic Three program:

> ...larger buildings (usually with six or more units) that do not have individual billing or trash and recycling service receive larger centralized black and blue bins to share, similar to their current citywide service. These large multiunit buildings do not get a green cart for compostables unless they requested one and identify a resident who will be responsible for the bin.[19]

Photo 3-8

There is less participation in green-waste collection by larger multi-unit buildings in San Francisco than by smaller residences, due to lack of storage space and the problems that come with composting food waste in tight spaces.

While it is estimated that close to 90 percent of apartments participate in traditional recycling, the Department of the Environment observed in February of 2002 that "few apartment buildings have joined the composting collection program so far. More outreach for them is needed and is likely to occur after the initial program roll out is completed."[20] According to the Department, "the biggest challenge for residents has been the number or size of containers for their small spaces, as houses often are connected to each other and garages are often small or nonexistent. Residents are encouraged and helped to find ways to fit the carts somewhere and/or share green or even blue carts with multifamily neighbors."[21]

Disposal

Despite its diversion accomplishments, San Francisco still disposes of some 270,000 tons of residential and 600,000 tons of commercial refuse each year.[22] As in New York, this refuse is exported by truck beyond city limits by private firms. Waste haulers deliver all refuse to one transfer station in San Francisco run by the Sanitary Fill Company, which is also owned by Norcal. Almost 90 percent of this refuse is transferred to the Altamont landfill 62 miles away in Alameda County, with the balance going to other regional landfills and a small fraction to waste-to-energy incineration. As of 2000, there were around 8 million tons of capacity left, which was projected as sufficient through 2008 with 40 percent diversion, 2011 if the city were able to raise diversion to an overall 60 percent (again counting all forms of diversion, including fill, millings, and C&D).[23]

Program Costs

According to San Francisco's Department of the Environment, the city does not evaluate the annual costs and benefits of recycling as part of the budget review process.[24] Officials there note that both state law and a general public consensus consider sustainability to be an undisputed requirement for local environmental policy.[25] This consensus, along with the fact that Norcal handles the day-to-day financial management of recycling, creates no imperative to publicly track system costs for waste management or revenues from the sale of recyclables.[26] Per ton costs for recycling and refuse collection, transport, and disposition, according to the Department of the Environment, remain "in the brain of the recycling manager."[27] Very roughly, however, officials there estimate overall costs at $200 per ton for refuse, and $150 per ton for recycling, with the difference explained by recycling revenues.[28]

Norcal retains all revenues from the sale of recyclables. The costs of collection, transport to Norcal's transfer station, and ultimate disposition (at a variety of landfills, WTE facilities, MRFs, and composting facilities in surrounding counties) are coordinated by Norcal at the corporate level.

Norcal, in fact, enjoys contracts with many California municipalities for collection, recycling, composting, and disposal services, and owns and operates 23 waste facilities statewide. In addition to handling San Francisco's residential waste, it also contracts privately with most commercial generators in the city (Photo 3-9). This extensive presence provides Norcal with economies of scale, as well as latitude and flexibility to shift resources, staff, and investment among its many subsidiaries. In addition, Norcal benefits from the city's contractual arrangements with the Altamont landfill, which is currently owned by another large waste firm, Waste Management.

In sum, user fees pay for the combined costs of collection, transport, and disposition of refuse, recycling, and compost in San Francisco. These services, from collection to disposition, are carried out by one private firm with an extensive network of subsidiaries and contracts with many generators statewide. For the most part, data on waste flows and costs are not publicly reported except in the broadest of terms. All of this means that comparison of the economics of recycling between San Francisco and New York is extremely difficult.

One possible way to approach the question of cost comparison is to look at the fees households pay to Norcal. Aside from a small amount of state and city funding for special projects, residential-waste management is funded directly by citizens, through their accounts with Sunset or Golden Gate, which are paid just like an electric or water utility bill. Most households pay a single monthly fee of $16.49 for refuse and recycling collection (and in Fantastic Three areas, organics collection), with a minority paying less or more depending on their rate of refuse generation.[29] With around 320,000 households, this translates to a yearly expenditure of around $65 million for residential-waste management, which means around $207 per ton for collection, transport and disposition of refuse, recycling, and composting *combined*, given the size of the current

Photo 3-9

The same private firm that collects all of San Francisco's residential waste under a pay-as-you-throw system also collects most commercial waste in the city as well.

residential waste stream. This would roughly coincide with the San Francisco Department of the Environment's estimate of $150 for recycling/composting and $200 for refuse, per ton.

However, the fees paid by residents do not entirely cover the costs of residential-waste management. While the rates households pay in San Francisco are slightly lower than average for the surrounding region, and are, in fact, regulated by the Refuse Collection and Disposal Rate Board, San Francisco *commercial* rates are unregulated and are far higher than the norm (approximately $114.86 per cubic yard of waste). A spokesman for Norcal stated that the sizeable profits from these commercial waste contracts, "help pay for a broad recycling program and for driving trash to the Altamont dump. They also help keep homeowners' rates down. The residents of San Francisco benefit because large downtown businesses pay a larger fee."[30] Thus the $207 figure probably understates the true cost of residential-waste management, although it is not possible to estimate to what extent.

Markets

Regardless of the true per ton costs of recycling, composting, and refuse management, what San Franciscans pay will remain fixed for the next several years under the Board's agreement with Norcal. No matter how favorable or disastrous the market for paper, metal, glass, or plastic may turn out to be, fees will not increase or decrease according to market conditions. Norcal will instead retain all recycling and composting revenues in exchange for running the city's overall waste-management program, as well as shouldering the risk of a volatile market.

It is reasonable to assume that Norcal, like any private firm, is amenable to such arrangements because there are profits to be made. And there are, in fact, several factors that make recycling and composting revenue potential strong in San Francisco's particular region.

Prices for recycled commodities have been consistently higher on the West Coast than elsewhere for over a decade. This is due to the proximity of West Coast ports to Asian markets, which are major buyers of recycled materials. (See discussion of how regional factors influence recycling markets in Chapter 1.)

In addition, California's strict recycled-content requirements, which make it mandatory for many products manufactured in the state to be made of 20- to 30-percent recycled materials, create an unusually strong market for metal, plastics, and even glass. (See section on *Recycled-content Requirements* in Chapter 1 for more information.) California's extensive wineries are large buyers of green glass, which further strengthens markets for these materials. Even mixed cullet finds a profitable outlet, as fiberglass manufacturers in the state have to abide by recycled-content requirements.

Furthermore, MRFs have a constant "market" for deposit-bearing beverage containers, as the State of California pays both public and private facilities for such bottles and cans *on a per-ton basis* that corresponds to the deposit value (1 to 5 cents) and not market value. MRFs can therefore count on a stable revenue source for a good portion of their materials.

What Can NYC Learn from San Francisco?

San Francisco is often cited as a waste-management model for other cities, including New York, to follow. The foregoing discussion highlights some important differences between the two cities, including the method of diversion rate calculation and the relationship of residential to commercial recycling in evaluation of municipal recycling success. When such differences are accounted for, it would appear that as of 2001, San Francisco's

residential diversion rate for *paper, metal, glass, and plastics only* was around 14 percent.[31] Most of its diversion, in other words, comes from commercial sources, or from composting and C&D/bulk recovery.

If changes to NYC's Local Law 19 were implemented to allow the Department of Sanitation to include C&D, fill, asphalt, and other such forms of diversion towards meeting its tonnage mandates, it would be fair to compare the recycling rate here to San Francisco's published 46 percent. The New York public, however, has demonstrated a decided preference for limiting official diversion measurement to that from residential recycling of paper, metal, glass, plastic, and through composting.[32]

With the continued expansion of the Fantastic Three program, San Francisco's residential rate may continue to climb, due largely to increased diversion of organics. This raises the question of how feasible a separate organics collection program would be in NYC. San Francisco's experience with multi-unit buildings suggests that organics collection may not hold the same degree of promise for large buildings that it does for smaller structures. This is, in fact, consistent with the experiences of large European cities. Curbside organics collection for in-vessel composting is common practices in the Netherlands and Germany, but is not practicable in large apartment buildings due to problems of contamination, space constraints, and odor/vermin concerns.[33]

The disappointing results of New York City's experiments with organics collection, which took place in 1992–1993 in Park Slope, Brooklyn and Starrett City, Queens, have been well documented in DSNY publications.[34] When considering whether a Fantastic Three program would be suitable for NYC, there are some hard questions about the feasibility and fairness of such a system. A full 64 percent of NYC's housing is in structures with more than five units. Would it be fair to offer (or require) separate organics collection among low-density housing in New York, and not in multi-unit apartment buildings? If separate organics collection were offered to *all* residents, who would be held accountable for the failure or success of the endeavor in apartment buildings—building owners, superintendents, or residents? And finally, even if collection hurdles could be overcome, is there a composting facility in proximity to New York City that would be permitted to accept some or all of the roughly 650,000 tons per year of yard, food, and soiled paper residuals generated in New York City?

In addition to these matters, a comparison of San Francisco's waste-management system to New York's raises a number of larger questions about service provision. The most obvious is the question of privatization. San Francisco has a long historical precedent of private management of residential waste. It has also succeeded, through its Rate Board and its contractual arrangements, in preventing Norcal from exerting monopoly control over the pricing of waste management. The long history of private collection (scavenging) in the city, and the consequent local structures for overseeing this industry, have resulted in the case of San Francisco in a close, nonadversarial relationship between the city and Norcal. Is full privatization needed to enable innovations such as the Fantastic Three program? If so, is full privatization an option for New York City? Given the complexity of Norcal's operations, and the fact that user fees from commercial and residential sources throughout California fund an extraordinarily complex network of private waste-management functions, there are no simple answers to these questions.

It is also likely that San Francisco's use of single-stream recycling collection (i.e., paper commingled with MGP), dual-bin trucks for recycling and garbage, and single-person crews substantially decreases collection costs there. Should NYC consider moving to a single-stream system? The question of the feasibility of such technology and labor arrangements in New York is, once again, not a simple matter given the vastness of territory, increased density, and differing transfer, processing, and disposal infrastructure available to us here. But the case of San Francisco does give us food for thought.

The Case of Los Angeles

If the California city of San Francisco is New York's counterpart in terms of housing density, predominance of apartment buildings, and low amounts of yard waste, then Los Angeles is its closest cousin in the sheer size of its population and waste stream. While Los Angeles's 3.8 million persons total a little less than half that of New York's population, it nevertheless ranks second after NYC in population rankings for U.S. cities (Photo 3-10). Its combined waste stream of almost 9.6 million tons annually[35] is second only to New York's combined total of 16.4 million tons. As *Waste Age* observes:

> Los Angeles waste market is among the world's largest. The city Sanitation Bureau's residential trash collection program ranks as one of the largest city-run programs of its type, serving 720,000 single-family households. According to Waste News's 2001 Largest Landfills ranking, four landfills in the L.A. metro area rank among the 10 largest disposal sites in the country, including the largest, the Puente Hills landfill, which took in 4.1 million tons of solid waste in 2000.[36]

Los Angeles and New York City also share another feature: a long-standing municipal workforce devoted to curbside collection of residential refuse, recycling, and yard waste. Los Angeles's Bureau of Sanitation, a division of the Department of Public Works, was formed in the early twentieth century to respond to the pressing need for timely collection and disposal of municipal waste that came with a burgeoning population.

Housing Stock and Provision of Service

Yet despite the opportunities and special challenges NYC and Los Angeles share, there are a number of crucial differences between the two megacities. The first concerns housing stock and population density. Los Angeles is notable for its decentralized layout, with no single downtown and many neighborhoods connected via roadways in a sprawling, settlement pattern. Though Los Angeles has half the population, its total land area is larger than NYC, around 470 square miles in comparison to our roughly 300. A major difference in population density follows. While nearly 26,000 New Yorkers cram into each square mile, L.A. residents have far more elbow room,

Photo 3-10

Among U.S. cities, Los Angeles is second only to New York City in population and the size of its waste stream.

with only 7,900 people on average residing in the same area. Not surprisingly, Los Angeles's distribution of housing among single-, two-, and multi-unit dwellings is quite different from New York's, as shown in Chart 3-1. High-rise apartment buildings are relatively uncommon in the "Big Orange" (Photo 3-11).

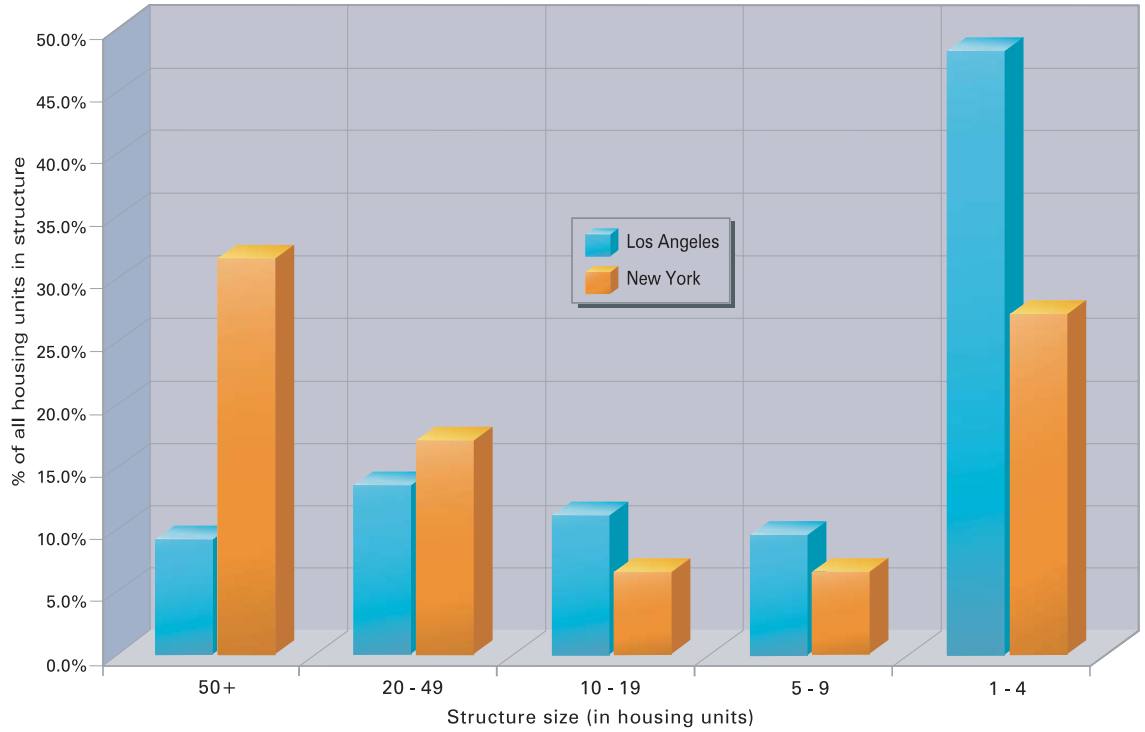
A second major difference concerns the division of municipal and private responsibility for waste management. The Los Angeles Bureau of Sanitation services buildings with three units or less. Buildings with four units and up must instead contract for private hauling, and draw from the same pool of private waste firms that service Los Angeles's commercial- and industrial-waste generators. Very few of these buildings recycle at all.[37]

Yet despite this departure from the New York model, the divide between public and private service is still in some respects similar to our own municipal/commercial distinction. For one segment of waste generators, the city is actively involved not just in designing and administering refuse removal and recycling programs, but also for implementing them. At the same time, many private hauling companies compete to provide services to apartment buildings and businesses. The situation is much the same in New York for the commercial vs. the residential sector. Here, DSNY is responsible for *all* NYC households; there, Los Angeles's Bureau of Sanitation provides service to a little over half of them.

Measuring Diversion, California Style

Another crucial difference between the two cities concerns the evaluation of recycling success in terms of tonnage and diversion. Like San Francisco, Los Angeles reports its official diversion rate as the sum total of all recycling, composting, and other forms of materials recovery and waste prevention for the commercial,

Chart 3-1
Variations in Housing Stock—Los Angeles vs. New York City



Source: U.S. Census 2000.

industrial, and residential sectors combined. This enabled them to claim an impressive, 60-percent overall diversion rate as of 2000.[38]

Los Angeles's combined waste stream from commercial, industrial, and residential generators is 9.7 million tons per year, out of which a total of 5.3 million tons were diverted in 2000. Around 2.3 million tons of this diversion consisted of materials other than paper, metal, glass, plastic, or organics—namely C&D material, clean fill, asphalt millings, harbor dredge spoils, and other heavy inerts.[39] This tonnage, if counted alone, would constitute 23 percent diversion for the city as a whole. Organics, predominantly yard waste, constituted another 11 percentage points, with traditional recyclables bringing in the balance of 21 percent.[40]

Unlike San Francisco, Los Angeles tracks diversion from buildings with three or fewer units. In 2003, the Bureau of Sanitation, serving 740,000 households, diverted 231,456 tons of recycling and composting combined, which translated to a diversion rate of 39 percent from this subsection of the residential population[41] (Photo 3-12).

Collection

Los Angeles's residential collection system has been fully automated since 1998. In that same year, the residential recycling program switched from a dual-stream system like New York's to a single-stream arrangement. Under the new program, residents of homes with three units or fewer are issued three, separately colored carts designed to work with the city's fleet

Photo 3-11

This view of Los Angeles shows high-rise office buildings, but few apartment buildings of more than a few stories. This housing stock is typical of the entire city.

Photo 3-12

Residents of L.A. housing with three units or less recycled 468,000 tons of yard waste in the year ending June 2002, but only 6,495 in the year ending June 2003, according to *Waste News*'s "Municipal Recycling Survey."[42]

of 510 automated single-bin trucks.[43] They are instructed to place commingled paper and metal, as well as glass and plastic bottles and jugs, in a 90-gallon blue cart; yard waste in a 90-gallon green cart; and remaining refuse, including food organics, in a 60-gallon black cart[44] (Photo 3-13).

Photo 3-13

In Los Angeles, residents of buildings of three units or fewer use a three-bin system similar to San Francisco's Fantastic Three, although food waste is not collected in the green bin—only yard waste.

Collection of most waste under this program is funded out of general taxes. However, Los Angeles's system incorporates a pay-as-you-throw element—residents are charged a fee of $5 on their monthly water bills if they set out more than 60 gallons of refuse. Alternately, they may buy additional capacity tags for $2.50 to affix to extra refuse bags. Similar provisions apply for excess yard trimmings and horse-manure collection. Extra recycling bins are available free of charge.

Photo 3-14

An L.A. Department of Public Works truck uses automation to collect recyclables from bins placed at curbside.

To accommodate automated collection, residents are also required to place carts at least three feet apart from each other or any other object at curbside on collection day. Three single-compartment trucks, one for each stream, come by weekly (all on the same day) to lift, tip, and replace empty carts using an automated grabber. At most stops, drivers never need to dismount the truck.

The implementation of automated collection for residential refuse, recycling, and composting has had major impacts. The first is increased productivity and cost savings. The city writes that the use of "fully automated trucks in a significant part of its operation...allowed it to significantly reduce its labor requirements and reduce operating costs."[45] Most notable was the reduction in crew size from two to one, and the improved speed of collection. Los Angeles's Bureau of Sanitation reports that as a result of automation, the city has reduced its collection staff and equipment by 25 percent.[46] Recycling routes have lengthened from 400 to 800 homes, and the collection rate has risen to 145 containers per hour.

With these changes have come a number of operational improvements. In 2000, the Los Angeles Bureau of Sanitation wrote that "until three years ago, the Division experienced overtime overruns, reduced 'on route

time' due to delays in morning dispatch and vehicle breakdowns, limited technology support operations, labor and management tension, low employee morale and a significant number of drivers who did not meet the previously agreed upon work standard for household refuse." They went on to explain that "over the last three years [the collections division] has undergone major changes in its operation, which resulted in improved operations and financial performance." Management has "reduced end of shift overtime by 36 percent since 1997," while "'on route time' increased to a full eight hour day." Efficiencies have been gained by several new technologies. Autocoach® and Routesmart® tracking software, combined with two-way radios, provide supervisors with minute-by-minute detailed information about work productivity on the street. A new automated timekeeping/dispatching system has been implemented, reducing absenteeism. And workers' compensation claims have fallen because automation places less physical stress on drivers.[47]

Many of these changes were facilitated by a joint labor/management committee of the Los Angeles Bureau's Solid Resources Collection Division formed in the mid-1990s to "encourage management and labor to collaborate on finding new solutions to a variety of critical issues facing the Bureau [of Sanitation],"[48] with the overall goal of improving operating procedures and lowering bottom-line costs. Since the 1998 changes were implemented, the committee's work has continued. Members have conducted research on waste management in major municipalities throughout the U.S., and have made visits to several of them to learn about improving diversion and cutting costs.[49]

The Bureau considers the move to automation and the implementation of the three-cart system among all residences (of three units or less) a tremendous success, writing that:

> Los Angeles residents took well to the new single-stream recycling program. Along with positive responses at community group presentations, an early survey revealed a customer approval rating of 92 percent. Additionally, the collection day set-out rate soared from 30 percent with the [two] 16 gallon yellow bins [one for paper, one for commingled metal, glass and plastic] to more than 80 percent with the 90 gallon blue containers. Participation by tonnage increased 150 percent.[50]

Contamination

The convenience of single-stream recycling in roomy carts has, according to the Bureau, been key to the positive reception of the program. In addition, the use of 90-gallon containers has reduced scavenging because the "larger container increases the time scavengers need to pull out specific commodities."[51] As in New York, scavenging of valuable materials from recycling has been an ongoing problem for L.A.[52]

At the same time, the implementation of single-stream recycling has caused contamination rates to rise from an estimated 10 percent, when residents source-separated recycling into two streams, to 25 percent, with "about a quarter of what's thrown in the recycling bins...either not recyclable or not recycled by the city."[53] In a *Waste Age* article profiling Los Angeles's program, a recycling program manager observed that a "handful of residents...'maliciously' contaminate the recycling stream...the problem is, that in a city the size of Los Angeles, a 'handful' easily can mean 10,000 residents and a significant negative impact on the quality of the recycling stream."[54] The city's research, he stated, suggests that malicious contamination takes place to avoid paying fees for extra refuse containers, since residents must pay for extra-capacity tags if they occasionally set out more than 60 gallons of refuse, and must rent extra black carts for $10 per month and extra green carts for $5 per month if their waste generation consistently exceeds the amount allotted (extra blue carts are free).

To combat this problem, L.A. has hosted several forums on contamination to which representatives of other California municipalities and private waste-industry representatives have been invited. The local official organizing these forums hopes that "with our diverse population...what we learn here in L.A. about contamination in a large-scale single stream recycling program can benefit other municipalities nationwide should they choose to go to single-stream collection."[55]

The city also plans to address what it calls "innocent" contamination (i.e., recycling refuse materials that are believed in good faith to be recyclable, but which are not) with several updated forms of public education. These include many of the same approaches that we use in NYC: a customer service guide mailed to all residents; truck signs; outreach materials for annual distribution to schools, civic associations, and other groups; and TV, radio, and print ads. The Bureau has also introduced "random task force checks of neighborhood containers and truck load audits at MRFs to track contamination and accumulate data to help the city determine what factors affect contamination levels (e.g. language barriers, extra-capacity fees, etc.)."[56]

In 2000, the Bureau of Sanitation viewed education, not enforcement, as key to controlling contamination "because patrolling 450 square miles can be costly and not necessarily effective. The city is hopeful that resident reeducation will reduce malicious contamination by informing the contaminators what the economic...and environmental detriments are to the city's recycling program."[57]

In February 2004, however, the Department of Public Works announced that any recycling containers "contaminated with materials that should not be deposited in these bins" would be left at curbside, with a tag informing the resident of the problem and asking them to call the Bureau of Sanitation's hotline for information on how to correct it. The move was undertaken because, according to Bureau of Sanitation Assistant Director Enrique Zaldivar, "Residents not properly using their green and blue containers is becoming a major problem.... Contamination undermines our efforts to recycle and divert refuse from precious landfill space."[58]

Multifamily Housing—Not Recycling

It should be recalled that the Los Angeles's recycling program does not apply to nearly 40,000 multifamily complexes with four or more units in thecity, which are home to around 600,000 households. In 1995, the last year in which data was compiled separately for this fraction of the privately serviced waste stream, multifamily residents disposed of 500,000 tons of refuse, the large fractions of which consisted of residual paper, mixed paper, and newspaper. According to city officials, "the sprawl of L.A. and the number of different languages make targeting [multifamily] waste a daunting task. Recycling participation amongst multi-family complexes seems to be limited because of increased cost from private haulers and lack of space for recycling containers in units and in the disposal area. The city has addressed this issue in new construction after 1992, but older buildings still remain an issue."[59] In reality, few multifamily buildings recycle at all.[60]

In 1997, the Bureau conducted a pilot study in which 214 blue containers were delivered to 71 multifamily complexes and tested over a period of months. The experiment yielded low participation and very small tonnages. As a result, "The diverted cost per ton was very high due to capital and labor costs."[61] The Bureau again attributed this result to the "transient nature of many apartment dwellers, many languages spoken in the city, resistance of apartment owners and managers, due to lack of space."[62]

As of July 2002, the city imposed a fee on private firms that service apartment buildings that amounts to 10 percent of what they charge their customers for refuse disposal. Haulers are not, however, charged for

collection and disposition of recycling at MRFs if they get customers to source-separate recyclables, or conduct post-collection separation themselves.[63] In January 2004, the city announced a new $6 million recycling pilot project to encourage apartment building recycling, funded from this 10 percent surcharge. This voluntary program will begin by targeting 100,000 of L.A.'s roughly 600,000 multifamily units. The city will contract with five private haulers to collect recyclables and implement public education. The pilot program is expected to have a diversion rate of 15 percent.[64]

According to L.A. statistics, apartment dwellers generated 21 percent of all of L.A.'s disposed waste in 2003, showing that this segment of the population contributes significantly to L.A.'s overall waste stream.[65] Yet until very recently, residents of multi-unit housing simply did not recycle at all. This fact highlights the difference between Los Angeles and New York—where multifamily recycling has been part of the program from the outset.

And within Los Angeles's real estate industry there continues to be reluctance to implement apartment building programs, and resistance to making apartment recycling mandatory:

> Los Angeles County requires private haulers to offer recycling if an apartment complex requests it, but few complexes do. Complexes say it's too expensive and there's no room for containers. Few owners want to pay the extra service fee.[66]

According to another official involved in apartment recycling:

> "There's a convenience factor lacking in apartment buildings," said Mark Alpers, vice president and director of Environmental Science Associates' solid-waste group, which runs apartment recycling programs in San Francisco, San Jose, and Santa Ana, and will start recycling at complexes in Los Angeles.[67]

Processing

Like New York, Los Angeles relies on the private sector to accept and manage the recyclables and refuse its collects (Photo 3-15). The Bureau of Sanitation currently contracts with six private, single-stream, materials-recovery facilities located throughout the city.[68] Each MRF is owned and operated by a different, local firm unaffiliated with national or international waste corporations.[69] These firms are doing well financially. Observes one *Waste News* journalist, "the city is fortunate to have an abundance of MRFs in the area that have a large pool of labor to put on the sorting lines. Recyclables also tend to fetch better prices on the West Coast, especially in overseas markets."[70]

Photo 3-15

Workers at an L.A. MRF sort commingled paper, metal, glass, and plastic.

Despite this capacity, the city's 2000 Solid Resources Infrastructure Strategy Facilities Plan, prepared by the Los Angeles Bureau of Sanitation's Board of Public Works, has argued that Los Angeles should construct its own mixed-

waste–processing MRF.[71] Noting that "inert" landfills tend to turn away commercial C&D mixed with organics (which places burdens on residential landfills), as well as the low recycling participation and diversion rate in multi-unit dwellings, this Plan states that:

> Although opportunities exist for residents and businesses to recycle, many are unable to provide source separation because of location, size, or other impediments. To increase the recycling rate in the City, the Bureau believes that the City should promote and support the development of Material Recovery Facilities which can accept mixed loads of construction and demolition debris, office and commercial bin waste, and potentially mixed residential waste."[72]

The Bureau believes that mixed-waste processing is particularly needed for "apartment complexes with large trash bins,"[73] and plans to conduct some pilot program testing of this recycling method in the near future.

Disposal

In 2000, Los Angeles voted to purchase two landfills in nearby Los Angeles counties for a total of $41 million each. These "mega-fill" sites (Mesquite Mine in Imperial County and El Sobrante, Riverside County) will supplement the existing network of landfills in other areas around Los Angeles, as well as in Arizona, that are needed to manage the city's massive refuse stream.[74]

Some of the existing capacity, however, is due to close. Much residential refuse is disposed of at the Bradley landfill (owned and operated by Waste Management, Inc.), which has only one to two more years of life. While other sites expect to be open for some time, Los Angeles expects to need additional disposal capacity of around 1,000 tons per day by 2004.[75] As a consequence, the city is looking into the option of developing "a transfer station in the central Los Angeles area that will allow access to desert rail-haul disposal facilities.[76] It is also looking anew at using waste-to-energy capacity near the city, observing that its current small contract with the Long Beach Incinerator for 100 tons per day of residential refuse yields a "potential tip fee savings of $160,000 per year."[77]

Costs

In their 1998 survey of recycling programs in other municipalities, the Los Angeles Bureau of Sanitation Solid Resources Collection Division's joint labor/management committee noted the difficulty of identifying and comparing refuse and recycling costs across jurisdictions, writing that:

> A detailed analysis of the funding structure of each participating agency is beyond the scope of this study...regional economic variations would not permit credible comparisons. Disposal costs, which vary regionally, significantly influence total costs. Some agency resources come primarily from their City's general fund, while others rely only on enterprise funds....Some agencies [use] cost data based upon 1988 data, while in other cases...information is more current....Most importantly, there is no template guaranteeing that the financial information from the agencies is collected and/or computed in the same manner as to permit credible comparisons.[78]

The same realities, of course, limit the extent to which we can compare New York City's costs to Los Angeles (or any other city). The city reports residential collection costs of $10.71 per household, per month ($1.72 for recycling, $3.24 for yard trimmings, and $5.75 for refuse), but does not calculate costs on a per-ton basis.[79] The cost of recycling collection is no doubt influenced by the choice of single rather than dual stream and the use of automated trucks. Transport costs are also mitigated by the fact that each Sanitation district has its own MRF.

At the same time, the implementation of single-stream recycling has driven processing fees up 20 percent to as much as $75 per ton, in contrast to landfill tipping which is $20 per ton.[80] In 1997, in anticipation of the program changes, the city re-bid MRF contracts, establishing a floor price of $5 to $10 per ton for single-stream recyclables. This agreement includes a tiered revenue-sharing arrangement tied to market prices. Revenues to the city are augmented by its redemption of deposit containers separated at the MRF, for which the state pays. This benefit, along with strong markets for paper, plastic, and most especially, green waste and composting, enable the city to generate significant revenues. In 2003, officials reported $2.4 million coming in from these operations.[81]

Los Angeles, San Francisco, and New York: Interesting Comparisons

Los Angeles's experience with recycling provides crucial insight into the challenges facing megacities like New York that must move millions of tons of waste up and out of their jurisdictions each year. The massive tonnages of refuse, recycling, and (in the case of L.A.) yard waste that are daily collected, transferred, and hauled beyond city limits drive an immense waste-management economy that surrounds each megalopolis.

It is important to note that although Los Angeles is in the same state as San Francisco, and therefore has the same state-level regulations (the California bottle bill, recycled-content requirements), and similar regional market advantages, it handles its recycling in some ways more like New York City than San Francisco. In San Francisco, collection is entirely privatized, while Los Angeles follows a public service model. San Francisco collects residential food organics; Los Angeles does not. And Los Angeles faces a contamination problem that does not seem to be an issue in San Francisco. These particular characteristics suggest that megacities face different challenges than cities that are merely "big"(Photo 3-16).

Photo 3-16

The United Nations defines a megacity as having a population in its greater metropolitan area of 10 million or more. L.A. and NYC are the only megacities in the United States. Others include Mexico City, Beijing, Bombay, London, and Tokyo. There are currently 20 megacities worldwide, 15 of which are in the developing world.

But both Los Angeles and San Francisco treat larger, multi-unit buildings differently from the rest of the housing stock—which makes them very different from New York. This difference has implications for comparing New York's residential diversion rate to that of San Francisco or Los Angeles. San Francisco does not track its multi-unit–building diversion rate, but the fact that such buildings generally do not separate organics suggests that multi-unit diversion is lower than the diversion overall. And in Los Angeles, multifamily diversion is not assessed because it forms part of overall commercial diversion, but it is also known qualitatively to be low.[82] These commonalities highlight the importance of being careful when we compare these cities to New York, the capital of the high-rise.

At the same time, it should not be overlooked that both Los Angeles and San Francisco are enabled by California state law to take a "whole systems" approach to assessing diversion success, counting all forms of material recovery (including reuse of C&D debris and other inerts, and estimates of business waste prevention) towards an overall diversion rate for the commercial, industrial, and residential sectors combined—and using a method that does not directly measure recycled tonnages.[83]

The whole system's focus, whether it be in a context of complete private sector provision (San Francisco) or a mix of public and private involvement (Los Angeles) reduces pressure on the residential sector for waste-reduction performance. For better or worse, it enables a very different determination of success. New York, in contrast, is circumscribed in what it can and cannot count as diversion.[84] It also calculates its diversion rate based on tonnage data that is directly measured daily. Unfortunately, this fact has been routinely overlooked when critics have compared New York to San Francisco, Los Angeles, and other cities.[85]

What Can New York Learn from Los Angeles?

The fact that both L.A. and NYC experience diversion and contamination problems (and San Francisco does not) suggests that these issues are to be expected when the population is immense. As one Los Angeles recycling official observed, the impact of "just a few" irresponsible citizens can be great when residents number in the millions.[86] The challenges of transience—especially since both L.A. and NYC are immigration centers—as well as language barriers are compounded when the city must educate a huge and constantly changing populace.

The Los Angeles experience also shows that reducing crew size, automating collection, and moving to a single-stream recycling system can result in major cost savings. As one Superintendent at the Bureau of Sanitation observed, "automated collection is the only way we can do recycling at all."[87] While single stream may present more challenges for MRFs, the strong markets for recyclables on the West Coast and the large number of competing recyclables processors make this method worth it (Photo 3-17). It is notable that such a significant alteration in work rules was accomplished under the planning guidance of a coalition of labor and management.[88]

Photo 3-17

Like San Francisco and Seattle, L.A. enjoys access to Asian markets for recyclables and exports much of its processed residential material abroad.

Finally, it is interesting to compare processing capacity for residential recyclables in the two cities. In both Los Angeles and New York City, a municipal agency is responsible for waste contracts with private MRFs that process commingled materials. Materials are then sold on the open market. Los Angeles's MRFs have, until now, resisted consolidation by larger waste-management corporations. The mix of labor and market conditions in Los Angeles may explain why they have managed to turn a profit processing mixed, somewhat contaminated, residential materials, as well as the fact that they have not sought to join the wave of industry consolidation that characterizes waste management today.

Nonetheless, Los Angeles's interest in building some public MRFs and transfer stations suggests that it seeks to maintain leverage in its relationship with the private sector. A memo from the Bureau of Sanitation Director to the Los Angeles Mayor in 2001 makes clear the benefits of balancing private sector capacity with city-owned infrastructure:

> The City does not own infrastructure facilities such as transfer stations and material recovery facilities, which support the Bureau's core business of providing waste management services to 720,000 households. The City is thus subject to changes in pricing and ownership of the large private waste companies that do own the infrastructure facilities which the City currently uses. Acquiring City-controlled facilities will provide more control over future price increases and more options for managing the materials the City collects at the curbside.[89]

The Case of Chicago

The city of Chicago has much in common with New York, and provides an interesting contrast to the California programs examined above (Photo 3-18). Chicago ranks third in the nation both for population size (2.3 million) and density (12,252 persons per square mile). While only 40 percent of its residences contain five or more units (as compared to 63 percent in NYC), its housing stock is as old as our own. Both here and there, the

Photo 3-18

Although it is not a megacity, Chicago's large population, housing density and age, and industrial history make it comparable in many ways to New York.

majority of homes and apartment buildings were built before 1960, when residential recycling first made its appearance on the national scene.

Chicago's combined residential and commercial waste stream is 5.2 million tons per year.[90] Like NYC and L.A., responsibility for managing this waste is divided between the public and private sector. Chicago's Department of Streets and Sanitation (DSS) handles collection of refuse, recycling, and yard waste from the city's 740,000 households in buildings of four or fewer units, and runs a separate collection program for the roughly 40,000 units of public housing. Its Department of Environment oversees education, planning, and marketing for recycling and composting. Commercial waste is handled by the private sector. Chicago's total residential stream totals around 3.1 million tons per year, out of which 22.3 percent was recycled in 2003.[91]

However, Chicago's municipal programs do not cover apartment complexes of five or more units. They too must arrange service with private haulers. Chicago's 1994 Workplace and Residential Recycling Ordinance requires property managers and building owners to implement a recycling plan specific to their property. Unless they qualify for a waiver, apartment houses are required to source separate at least three recyclables of their own choosing. They also have the option of substituting one separation with two source-reduction measures.[92]

With the exception of the fact that apartment houses are served by private hauling firms, Chicago's commercial-waste–management system is very much like New York City's. Businesses are serviced by a mix of independent and national carting companies. As in NYC, waste haulers in Chicago are required to report data to the city on both the types and amounts of materials collected for recycling on a semi-annual basis. Failure to report risks loss of license.

The Blue Bag Program

What makes Chicago's residential recycling distinctive is its one-stop collection method, the "Blue Bag" system. This program, initiated in 1995, enables residents to source-separate their waste into three streams. Refuse goes into black bags; commingled paper, metal, glass, and plastic into blue bags; and yard waste into separate blue bags. Everything must then be placed in one or more 96-gallon carts at curbside.

All three separations are collected *in the same truck* (Photo 3-19) and delivered to a mixed-waste Materials Recovery Facility, sometimes known as a "dirty MRF," for extensive sorting. At the end of the recovery process, the MRF yields processed streams of paper, metal, glass, plastic, and organics—all of which go to beneficial use—as well as refuse, which is transported to a landfill. Costs are funded entirely through general taxes.

In 2001, Chicago's Department of Environment Commissioner stated that "We've now got a mature program that's really performing well."[93] According to the agency, diversion under the program reached 26.8 percent in 2000, although in 2001 it dropped to below 25 percent for the first time in four years.[94] It is notable that these rates were achieved despite rather modest participation levels. Periodic alley surveys had determined that "approximately 33 percent of residents that are eligible to use their blue bag program actually participate in it."[95] Unlike in NYC, Chicago's program is not mandatory; residents may place recyclables in blue or black bags as they wish. Many choose not to source-separate.

Recycling in the city's public housing projects is handled somewhat differently. Echoing the conventional wisdom about the diversion-income connection, Chicago planners have observed that "not unlike other large cities, Chicago's diverse population presents challenges when it comes to getting residents of different

socioeconomic backgrounds to recycle."[96] But while studies in New York and Los Angeles have explained lower diversion in lower income areas by looking at the baseline composition of the waste stream, Chicago takes a different view:

> ...officials knew the standard blue bag program would not work for this [the public housing] sector of the population for two reasons: the out-of-pocket expense required to purchase the blue bags, and the fact that most public housing units are in high-rise buildings, which are not conducive to blue bag collection.[97]

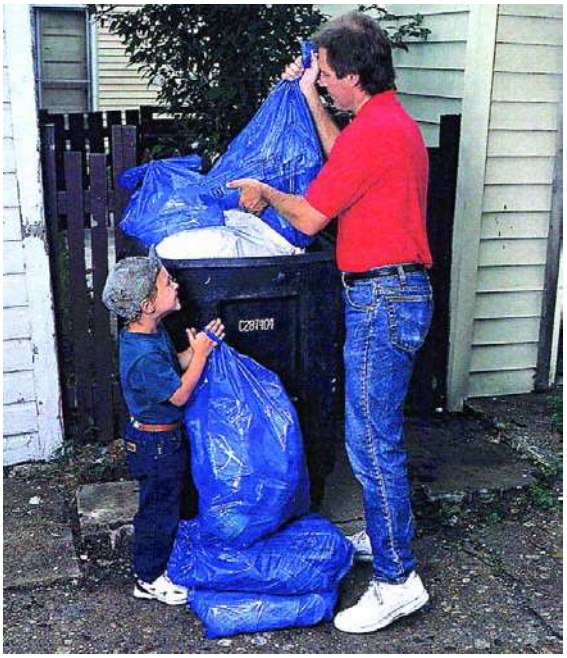
At the time the Blue Bag program was introduced, it was felt that the barriers of high density and low income were too high to surmount among the public housing population. Consequently, Chicago never implemented the Blue Bag system in its 40,000 or so housing authority units. Instead, it contracted with a nonprofit group called The Resource Center to institute a different arrangement. Each day, the Center sends buy-back trucks to housing project sites. Residents exchange paper, metal, glass, and plastic recyclables for vouchers, which can later be redeemed for cash. Recyclables are bought at the going market rate, calculated by weight. Collected materials are taken directly to one of the two MRFs owned by Waste Management to be processed and marketed with Blue Bag materials. In 1999, this program paid out roughly $140,000 to residents. It also provided local employment, since buy back vehicles were staffed by neighborhood residents.

Chicago's MRFs

In light of the Blue Bag program's modest level of participation, Chicago's residential diversion rate of around 25 percent is impressive. This rate exceeds the 20 percent attained in New York City before the temporary suspension of glass and plastic collection from the curbside program—even though New York's participation rate was then around 80 to 90 percent.[98] But a closer look at Chicago's mixed-waste–processing system (as well as its method of calculating diversion) explains how such lackluster participation was able to translate to respectable diversion.

Photo 3-19

Top photo: Unlike most other U.S. cities, Chicago residents place blue bags full of recycling in the same bin with refuse. Bottom photo: A worker from Chicago's Department of Streets and Sanitation loads a blue bag into a packer truck that also collects refuse. Note the automated lifters that are used for large, curbside bins.



As a recent article in *Waste Age* reported, "the long-term success of Chicago's blue bag program is crucial because the city invested much up front capital and resources....It spent millions...to construct four custom-designed sorting centers that handle both residential solid waste and recyclables from the blue-bag program."[99] Today, the city uses these MRFs—two of which are city-owned and two of which are owned by Waste Management, Inc. (WMI)—to handle all residential waste from the Blue Bag program. WMI operates all four facilities. Under its contract, the city offers WMI incentives for increased diversion, and levies penalties if diversion falls below a certain level.[100]

Three-person city crews collect blue and black bags at curbside weekly using single-compartment, rear-loading, semi-automated packer trucks. Crews consist of one driver and two additional workers, who either load manually, or use automated lifters to assist in emptying curbside bins into the hopper. Trucks then transport and deliver all material—including blue and black bags—to one of four MRFs, each of which is located within city limits. Upon delivery, blue bags of commingled recycling are retrieved and sent to a recycling sort line, where they are mechanically debagged. Commingled containers are separated using a mix of standard manual and automated sorting methods (magnets and eddy currents). Glass bottles that remain intact are color-sorted by hand.[101] Manual sorting also removes #1 and #2 plastic containers, as well as the blue bags themselves which are also recycled (Photo 3-20).

Photo 3-20

Trucks carrying bags of recyclables and refuse unload at one of Chicago's four Materials Recycling and Recovery Facilities. Blue bags carrying recyclables are sent to a separate sort line, where materials are mechanically and manually sorted.

The refuse stream is fed into a separate sort line, where pickers remove wood, certain bulk plastics (mainly buckets), and bulk metal—as well as designated recyclables that were not placed in blue bags. The remaining discards are sent through a magnet/eddy-current process to retrieve residual metals. After this, material passes over a two-inch screen that separates out an organic-rich fraction of fines. What remains after screening is sent to any number of area landfills in surrounding counties.

Photo 3-21

Much of Chicago's organics are applied as "compost amendment" on farms such as this one outside the city.

Processed paper, metal, and plastic is sold to a wide array of processors and manufacturers with whom WMI has relationships. Glass—much of which is broken mixed cullet—is shipped to a second "glass MRF" run by WMI, where it is optically sorted by color. Meanwhile, blue-bagged yard waste is sent to a separate manual sort to remove contaminants, and is then blended with screened material from refuse. This mixture is sent to compost facilities and other end-use sites outside the city (Photo 3-21).

The combined use of co-collection and a dirty-MRF system cuts down on problems of contamination, low participation, and low capture that can occur when recyclables are collected and processed separately from refuse. That said, even with post-collection sorting of refuse to retrieve recyclables and organics, roughly 75 percent of what is collected is still landfilled.

Program Costs

In 2001, Chicago's residential collection budget was $157 million.[102] While per ton collection costs are not published, it is clear that the consolidation of recycling and refuse collection has yielded economies—even with crews of three working truck shifts. As officials from the city's DSS have observed, "one of the reasons city officials decided to implement the blue bag program was to avoid the costs of a separate fleet of collection vehicles and separate sorting centers for recyclables. Commingled collection allows us to bring recycled materials to our sorting centers without additional crews or trucks and, subsequently, without additional vehicle emissions."[103]

In the mid-1990s, the city paid WMI $60 million to build the four MRFs, only two of which it still owns, since the construction agreement gave WMI title to the remaining two. This up-front expenditure has enabled the city to negotiate quite favorable processing and disposal fees for residential waste. It pays WMI $22 per ton to accept its recycling, and $44 per ton for refuse handling (including landfill disposal).[104] WMI in turn retains all revenues from the sale of recycled commodities and organics. As an incentive to keep the diversion rate at or above 25 percent, the city's contract provisions cap disposal payments at 75 percent of the annual total-waste tonnage. WMI must also pay penalties if diversion falls below 25 percent.

WMI is not, however, contractually bound to actually recycle the segregated material. For two months during the winter of 1997, for example, all collected mixed paper and corrugated cardboard were landfilled, due to lack of markets, compounded by heavy rates of contamination. While the city withheld payment on its

contracts and WMI paid $1.1 million to landfill 28,275 extra tons, this option was still more cost-effective than recycling during that period. The state of Illinois has unusually low landfill tipping fees, making disposal there a constant competitor to recycling.[105]

Nonetheless, since inception of the Blue Bag program, collection costs have dropped $5 million per year. At the same time, handling and processing costs have consistently increased.[106] Officials note that the increase has not been caused by shortfalls in recycling revenues, but instead reflects the realities of processing mixed waste.[107] Although recycling mixed with refuse is more efficient to collect in one truck, it takes much more labor and time to sort.

Public Opinion

Despite the simplicity of Blue Bag recycling and the 25-percent diversion it yields, the program is not without its critics. Citizens have, over the years, objected to the contamination that co-collection brings about. The city has responded that these and other concerns have been addressed by reducing the compaction rate in the trucks to cut down on breakage.[108]

In addition, some of the program's detractors allege that having to purchase blue bags in addition to black ones makes participation inconvenient, and acts as an incentive to instead just throw everything into one bag of garbage. In their view, it is not only public housing residents who are deterred by the expense and bother of two sets of bags. Some citizens have also expressed distrust of the entire recycling process because they witness refuse and recycling tossed into the same truck. The much-publicized incident of the landfilling of Chicago's paper in 1997 has reinforced these suspicions.[109]

Another controversy has arisen over the large tonnage of organics that are counted in the diversion rate each year. As the city explains:

> In the Sorting Centers, once the Blue Bags containing yard waste are separated during the Primary Sort, they move to a separate area where sorters remove contaminants, any trash or recyclables that are not yard waste. Small bits of organic matter are recovered from the general trash too by a process called "screening." This material is composted. Much of Chicago's yard waste is sent to a farm and used as a "compost amendment" adding nutrients to the soil in the fields.[110]

In Kankakee County, where this farm is sited, a scandal arose in the late 1990s when "the rancid smells and high truck traffic generated vigorous local opposition."[111] As a result, land application of Chicago organics at this site stopped, but the continued use of compost from the Blue Bag program as landfill cover has also drawn public criticism.[112]

What Can NYC Learn from Chicago?

Like New York City, Chicago reports its "official" diversion rate as its residential rate. In 2003, this rate was 22.3 percent, a figure comparable to New York's before the temporary suspension of glass and plastic. Different from New York is the current administration's long-term plan for waste management. Mayor Richard Daley has explicitly advocated an "environmental agenda toward the goal of sustainable development."[113] His legislative approach to the environment is focused on actively pursuing change at the state and federal level.[114] Policies his office advocates include: federal procurement of recycled products; federal encouragement of source reduction as a "cost saving technique for business"; national recycled/minimum-content standards to "characterize what

can be sold as recycled"; a national Bottle Bill; the listing of used oil as nonhazardous and promotion of reuse and recycling; federal guidelines for disposal of used tires; the reduction of subsidies for virgin materials; and federal incentives for buy-back of light bulbs.[115]

The case of Chicago suggests that taking a whole-systems approach to assessing diversion success is feasible even in a city very much like New York in history, politics, and culture. Whether fact or myth, old, industrial cities like New York, Chicago, Boston, and Philadelphia have the reputation of being less "environmental" than their newer cousins on the West Coast. Yet in Chicago, sustainability is an explicit goal on the city agenda.

In addition, Chicago's eight years of experience with co-collection and mixed-waste processing provides good information about the benefits and pitfalls of such a system. Unlike Los Angeles, and San Francisco's three-cart, automated-collection system, the Blue Bag method could be easily implemented in New York, as it would require no major changes to trucks, crews, or curbside practices.

At the same time, Chicago's experience tells us that such a program cannot work without immense mixed-MRF capacity. It is notable that the city did not rely on the private sector to come forth with the complicated and massive processing services it needed—it recruited and paid one large firm to build and operate its own system. Given the lack of such mixed-MRF capacity around New York, NYC would need to undertake a similar capital project of more than double the size to even consider co-collection.

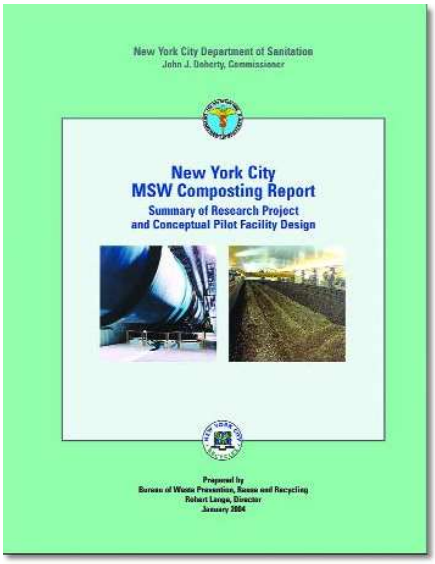
Chicago currently pays significantly less than New York for processing and disposal, while its collection costs are roughly comparable to ours. On the other hand, WMI retains all revenues from the sale of recyclables—including paper. The contamination of paper and the low cost of Midwest landfilling in comparison to the Northeast, make paper a less profitable proposition. WMI no doubt does not reap the same revenues from its paper that NYC's processors do, and sometimes finds disposing of it cheaper than recycling at any price. Nonetheless, Chicago has chosen to forego a potential source of funds from the operation of facilities that it paid to have built. This throws lower processing and disposal costs into a different light. And given the fact that the same large corporation that owns two of the city-funded MRFs, and operates all four, is rapidly consolidating independent waste businesses in the Chicago area, it is not unreasonable to expect that costs will continue to rise with the next contract negotiations.

Chicago's experience also points to the crucial role that organics diversion would have to play in making any Blue Bag program capable of diverting a substantial amount. Yard waste makes up around 20 percent of Chicago's residential waste stream (recall that 23 percent of its housing is single-family, *detached*, as compared to around 8 percent in NYC). Nevertheless, to maintain a 25-percent diversion rate, WMI augments the yard-waste stream with organic fines from refuse. It is notable that this blend, which for a period was shipped to outlying counties in Illinois for land application, goes through only minimal processing and curing beforehand.[116]

If organics are needed to make up the lion's share of diversion under a Blue Bag program, then mixed-waste *composting*—which is a different process from mixed-waste processing—seems a better alternative to a dirty MRF. Mixed-waste composting uses advanced technology to process much of the refuse stream, including food, yard trimmings, and paper, under anaerobic and aerobic conditions that promote rapid, yet complete, decomposition. Its output is a hygienic, odor-free compost that can be used, without concern, for landscaping and other horticultural purposes. What is left after the mixed-waste–composting process are certain recyclables—plastics, metal, and large-fragment glass—as well as a small amount of non-recyclable, inorganic materials.

The NYC Department of Sanitation explored municipal solid-waste–composting technology in its report, *New York City MSW Composting Report: Summary of Research Project and Conceptual Pilot Facility Design* (Graphic 3-2). This report explores the state of MSW composting, examines the quality of compost produced from this technology, and presents a proposal for how to test MSW composting in New York City.

Graphic 3-2
New York City MSW Composting Report



The Case of Seattle

No comparative study of recycling in U.S. municipalities would be complete without looking at Seattle, a city long considered as the vanguard of recycling in the United States. Seattle is considerably smaller and less dense than NYC, with a population of a little over half a million citizens, a quarter million households, and around 6,700 persons per square mile. Like most cities, it has far fewer multi-unit buildings than New York. Only 37 percent of its units are in buildings of 5 or more units, including 20 percent in complexes of 20 apartments or more (Photo 3-22).

Diversion

In the 2003 Municipal Recycling Survey published in *Waste News* in February of 2004, Seattle reported an overall diversion rate of 38 percent for residential and commercial recycling and composting combined. The city also keeps extensive statistics on residential diversion, which was 43 percent for the year 2003 for curbside programs.[117]

Out of curbside residential diversion, 30 percent was accounted for by recycling of paper, metal, glass, and plastic, and another 13 percent came from yard-waste composting. Curbside diversion included both single-

Photo 3-22
Seattle is considered at the forefront of municipal recycling in the United States.

and multifamily housing.[118] While the city's published reports don't track multifamily diversion rates specifically, they do show an average of 327 pounds of recycling generated per year, per participating unit.[119] This is considerably less than the 812 pounds per year of recyclables (not including yard waste) that households in buildings of four units or less set out for curbside collection, but units in larger complexes may also generate less refuse.[120] Thus, the multifamily recycling rate is probably lower than 30 percent for paper, metal, glass, and plastic under the city's curbside program.

Service Provision

Single-family houses and buildings with two to four units generate about 54 percent of residential waste, while apartment complexes put out another 20 percent.[121] The remaining 26 percent is hauled to transfer/recycling stations by residents themselves. Residents of single-, two-, and three-family housing choosing curbside service pay variable rates for weekly refuse waste-hauling, but receive biweekly recycling collection free of charge. Those who opt to self-haul their waste to one of the city's several transfer stations pay more modest fees for tipping trash and yard waste, and can drop off recycling there for free.

Residents subscribing to curbside, alley, or backyard collection pay monthly rates for trash collection that range from $10 for a 12-gallon "microcan" to $67 for backyard pickup of a 96-gallon cart. For an extra $4.25 per month, they can also arrange biweekly collection of leaves, clippings, and other yard materials. They must either choose this option or haul yard waste to transfer points themselves, since Seattle has a local ban on landfilling yard waste. Recycling, on the other hand, is voluntary, although residents are prohibited from disposing of tires (which must be taken to a drop-off center) and bulk items (for which there is a $20 collection fee) in their trash. Taken together, the yard and recycling arrangements provide strong financial incentives for residents to divert waste from refuse. This is especially true in the 60 percent of the city's housing in buildings that are four units or less, because in these cases individual "customers" pay for collection directly.

Billing for refuse and yard-waste collection is coordinated through Seattle's Public Utilities (SPU) department, which contracts with two private waste-haulers, each of whom has exclusive rights to service a section of the city. These same firms offer refuse and recycling collection to apartment buildings, although the decision about whether or not to recycle in these cases is left up to each building manager. In order to encourage apartment recycling, SPU's contracts include financial incentives for the two firms to maintain recycling in between 70 and 80 percent of the nearly 5,500 apartment buildings in Seattle. It also runs the "Friend of Recycling" program, which offers training sessions for volunteer tenant coordinators, along with a $100 annual rebate on trash bills to the building management if a tenant agrees to coordinate recycling on site.

This approach, according to SPU, has increased participation among multifamily dwellings over the past three years (Photo 3-23). SPU officials note that "transient populations as well as space downtown and older buildings are

Photo 3-23

Seattle's housing stock consists of small apartment buildings and houses in a low-density arrangement. High-rise apartment buildings are relatively uncommon.

problematic," for recycling.[122] These buildings figure among the 20 percent not participating in recycling at all. In addition, if a building consistently contaminates recyclables, firms have the option to terminate recycling service. This, according to SPU, has occurred in "between 50 and 100 buildings."[123] Excluding the "bad apples" among Seattle's apartments is quite effective, leading staff member Hans Van Dusen to conclude that "that multifamily participation is not the highest in the country, but the program's low levels of contamination are among the best, albeit higher than single family."[124] He notes that "haulers and city contract managers have had and will continue to have the option of pulling service at a building where contamination levels cannot be corrected. These buildings go back to the pool of nonrecycling targets."[125] Van Dusen estimates a 4 percent contamination level for apartments that recycle, and a 2 percent contamination level for the city's residents overall.[126]

Collection and Processing

SPU regulates rates, subsidizes recycling collection, requires its contractors to collect yard waste and recycling separately from refuse, and specifies the MRF these haulers will use. However, it leaves design of source-separation arrangements and collection methods up to the individual firms. When contracts were re-bid in 1999, they were awarded to two haulers (WMI and Allied), each of which won the exclusive right to service a section of the city. Both chose single-person, semi-automated trucks to collect two streams of recycling consisting of: (1) commingled paper, metal, and plastic; and (2) separated glass. WMI selected a dual-bin rear loader that would compact both streams separately; while Allied opted for a single-bin compactor for the commingled materials, with a separate box for glass mounted between the truck cab and the 20-cubic-yard hopper in back. Fully automated trucks were deemed unworkable in the many narrow alleys and hilly sections of the city.[127]

The decision to keep glass separate was made as a result of experiences earlier in the decade with glass contamination of paper fibers. The firms serving the city under the previous contract, which lasted from 1989–1999, had required three source separations (paper, metal/plastic, and glass). Several experiments with single-stream collection during that time led to complaints from paper mills about glass and problems with the marketability of the end product. While the new contracts have retained the separated-glass provision, SPU anticipates that the city will move to a full single-stream system in the near future, because of improved processing technologies. The MRF serving the city, Rabanco (now owned by Allied), is currently undergoing modernization to handle commingled paper and glass (Photo 3-24).

Photo 3-24

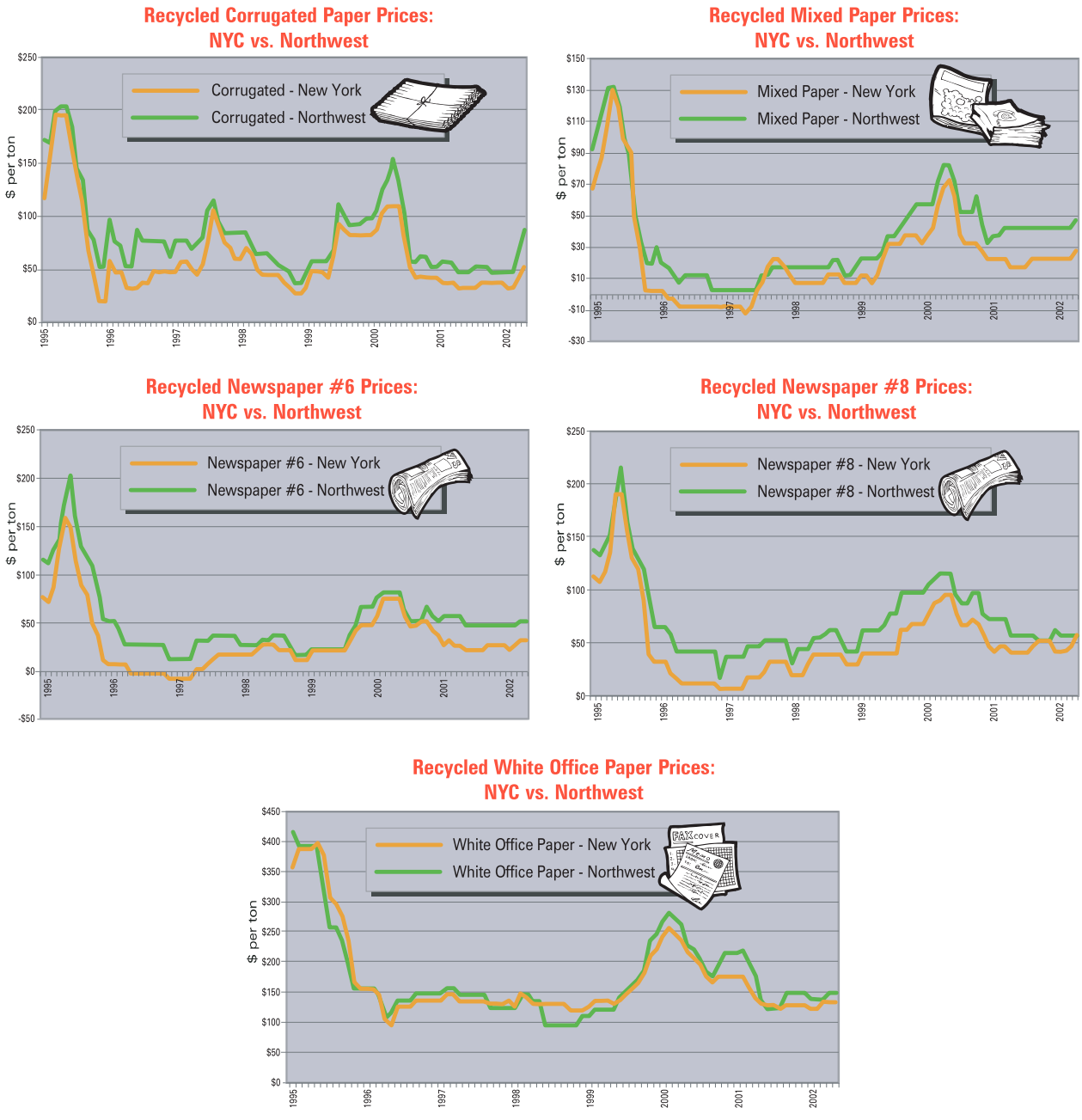
Haulers under contract with Seattle Public Utilities use single-person, semi-automated trucks to collect recyclables. The Rabanco MRF shown here (now owned by Allied) is undergoing modernization to handle commingled paper and glass.

Moreover, WMI operates a single-stream MRF in Seattle for commercial and out-of-town residential recycling, and is constructing another large, single-stream MRF in the surrounding King County. In Van Dusen's opinion, reticence on the part of mills to accept paper co-collected with glass is unfounded, given today's technology.[128]

Markets

As shown in Chart 3-2, paper markets are stronger in the Pacific Northwest than in the East. This strength reflects the region's well-developed paper industry, as well as its trade linkages with Asia, which buys 25

Chart 3-2
Price Variation in Recycled Paper Prices between NYC and the Northwest



percent of Seattle's recycled paper alone (Photo 3-25).

Photo 3-25

As with cities in California, Seattle's location on the West Coast makes it a prime exporter of materials to Asia and the Pacific Rim.

Roughly half of Seattle's HDPE and PET go to export markets in Asia as well, and the high demand for glass in nearby California (due to that state's recycled-content requirements) create a steady outlet for this material.[129] Much of the separately collected glass is taken from the MRF to a glass-beneficiation facility, where it is optically color-sorted. Clear, green, and amber glass typically finds ready buyers to the south, although SPU staff report that when glass markets are weak, its contractors may forego optical sorting and sell all glass locally as mixed cullet for a minimal price. The State of Washington, moreover, has no bottle bill. This increases the fraction of aluminum in the recycling, which—according to SPU economist Jennifer Bagby—accounts for 25 percent of recycling revenue, even though it represents only 2 percent of the recycling collected.[130] (In comparison, aluminum represents only 0.6 percent of New York City's waste stream.[131] Seattle also collects other plastic resins (numbers 3-5, but not polystyrene), but reports that regional infrastructure and markets for them are limited.[132]

Program Costs

Much of the revenue needed to fund Seattle's programs comes from its subscription accounts. State, county, and municipal grants round out the waste-management budget. SPU in turn pays the two firms that collect and process garbage, recycling, and yard waste; and contracts with a third (WastebyRail) to export waste to landfills within and outside the state. Depending on market conditions, the total cost of recycling may be greater or less than the costs of refuse collection, tipping, transfer, and landfilling. For instance:

> In 1993, the savings from the recycling program totaled $98.50 per ton. This amount can be broken into four components. The first is the avoided costs of collection...the savings from not having to collect the material was $32 per ton. Additional savings are attributable to not having to transfer or transport the material. Finally...there were savings in 1993 from disposal of $44 per ton. The costs of the recycling program in 1993 included a $93 per ton payment to the contractors who collect the material plus $2 per ton for administration and public information costs incurred by the City. Thus, in 1993, the costs were $3.50 per ton less than the benefits.[133]

By 1994, strong markets had driven the cost per ton of recycling to $77, making it approximately $15 less costly per ton than refuse collection. This annual variation in recycling costs comes from the structure of Seattle's contracts with its processors. SPU pays WMI and Allied a per-ton fee for recycling collection, which (as of the year 2000), averaged around $64. Another $19 per ton goes to Allied to cover processing at the MRF.[134] The city shares the risk for market variation in commodity prices by reimbursing the contractors if prices fall below a set level and reducing payment by the amount prices rise above that same level.[135] As a

consequence, over the past 12 years the cost per ton for recycling has ranged from a low of around $20 per ton during the bull market of 1995, to a high of $100 per ton in 2002.

The City of Seattle protects itself from extreme market volatility through a clause in each contract specifying that, "if the market price indicator for any material falls below $0, the city may at any time direct the Contractor to deliver the material to a city transfer station or other location within the city rather than pay the additional differential below $0."[136] In other words, the city retains the right to landfill or otherwise recycle the materials if markets are very poor. Moreover, the contracts make special allowances for potential problems arising with glass, stating that if the "glass beneficiation plant will not accept all, or a portion of one of the above colors, that color, or a portion of color, will be calculated at $0 value."[137] This addresses the fact that in the absence of markets for color-sorted glass that cover the cost of optical sorting, mixed cullet usually commands no positive price.

What Can NYC Learn from Seattle?

The City of Seattle rightly earned its reputation as a national recycling leader because of its early and continued commitment to recycling and other forms of waste reduction—and its achievement of measurable results. As one SPU report noted in 1999, "Seattle's program became a byword among cities, a success story acclaimed worldwide...Why? Because Seattle increased recycling from 28 percent its wastes in 1988 to 44 percent in 1995."[138] While this diversion rate fell short of the city's initial goal of 60-percent waste reduction by 1998, it was nevertheless high among programs in the mid-1990s.[139]

Other elements of Seattle's waste-reduction programs, such as its monthly "recycling newsletter" (sent to all curbside collection subscribers), its detailed program evaluations, its food-waste–composting programs at local markets, and its backyard-composting initiatives, earned the city recognition as well. But it is important to keep in mind that the city's own literature shows that, by and large, its "traditional" curbside programs for recycling and yard waste account for its reported diversion rate of 43 percent, 30 percent of which was curbside recycling.[140] Here we find ourselves again at the observation made so many times in the course of this report—that when we compare New York to other cities for residential diversion of paper, metal, glass, and plastic, what were seemingly huge differences turn out to be much more modest.

This suggests that what New York has to learn from Seattle is not how to increase the diversion rate or how to conduct public education, but how to recycle more cost-effectively. In this regard, a great deal depends on how provision of recyclables collection, processing, and marketing is structured. SPU's contractual arrangements with private haulers have enabled it to pass on costs to customers in the form of rates that are affordable, and maximize diversion. At the same time, Seattle has intervened in the private market at key points to guide the system in a direction that is not just economically efficient, but also environmentally and socially sound.

While privatized, Seattle's system is anything but *laissez faire*. SPU heavily regulates the residential hauling industry, telling it where it can collect, what it must collect and process, and how much it can charge. In the case of yard waste, economic incentives for diversion have been reinforced by the command-and-control legislation of the landfill ban. The city has retained ownership of two recycling and disposal stations. This reins in potential abuses of a purely free-market arrangement by offering lower income residents the less-expensive option of self-haul, as well as retaining an element of competition from the public sector. In addition, the city supplements funding from subscriptions with municipal, county, and state grants, which mitigates the cost-competitiveness of disposal over recycling when markets are weak. At the same time, it structures revenue-sharing such that it is protected from serious market downturns, limiting its risk exposure.

Despite this heavy regulation, the fact that Allied and WMI have agreed to such conditions suggests that it is reasonable for them to expect at least modest profits over the duration of a 10-year contract. Here the strong markets of the Pacific Northwest are no doubt key, as is the fact that both hold exclusive franchises for collection of refuse and recycling. Thus, these large companies may be able to spread costs and earnings across operations, making processing and marketing a more profitable venture than if they only accepted the materials collected by someone else.

Does Seattle's success with this arrangement mean that NYC should follow its lead (or the lead of San Francisco, with a similar system)? Both cities have a long precedent of private collection. For decades, residents have paid directly for waste-hauling, as commercial enterprises do here. The transition from the publicly provided sanitation arrangement that has existed in New York since the 19th century would no doubt be painful, difficult, and would impact lower income residents the most. But over and above these challenges, NYC would have to think about how to structure its relationship with one, two, or even three very large companies such that it retained control over its own waste-management system. The case of Seattle shows this very clearly.

Chapter Conclusion: Applied Comparison

This comparative exercise reveals several key findings. The first is that the organization, funding, and split of public to private responsibility for collection, processing, and disposal varies widely from city to city, even among cities subject to the same state laws (Los Angeles and San Francisco, for example—see Table AVI-3 in Appendix VI). The costs of running a recycling program may form part of the overall waste-management budget and be funded out of local taxes. At the other extreme, costs may be covered by direct fees paid by consumers of waste-hauling. There is no general rule as to how commercial and residential streams break down in terms of service provision or any other attribute. Similarly, what is the direct responsibility of government, what falls under municipal contract to an outsourced provider, and what is a private matter between waste hauler and generator-consumer, differs in each city.

A second point is that despite the widespread variations, all large cities contract with one or more large, private firms that *process and market recyclables*. It is notable that in all cases the reach of these corporations goes beyond the locality. Regardless of how programs are funded, municipal recyclables end up being privately sorted at MRFs and then entering a regional, national, and even global market. While cities may encourage local businesses that use recycled materials, recycling takes place on scale beyond the city itself. And in three out of the four cases, the same firm contracted to handle recycling also managed refuse disposal. With the exception of San Francisco, the cities' recyclables processing contracts are with one or both of the two "waste giants." In sum, among these and in fact all U.S. cities, recycling is part of a large, global waste-management industry.

Third, this analysis shows that comparing recycling costs (and revenues) among cities is not just extremely difficult—it is ultimately not useful. So many factors go into program funding, allocation of costs, structuring of payment and revenue provisions in contracts, that line-item budget comparisons make little sense. Furthermore, regional factors—including the wage and tax rate, the strength of markets, the cost of landfilling, the public vs. private ownership of processing and disposal facilities—vary greatly, yet their contribution to costs is difficult to quantify. Thus, there is no where to simply "look up" what it costs to recycle or to dispose of refuse in any particular city, nor is it prudent to evaluate a city's recycling costs using anything but that city's own information.

The interaction of geographic and state policy factors has a great deal to do with the revenues municipalities can expect from the sale of recyclables. But the effect of revenue potential on program economics is not straightforward. There are many types of contractual arrangements between municipalities and recycling processors. Among them, revenue sharing between the two parties is by no means the norm. Many private processors retain all revenues *and* charge processing fees. Others give municipalities a certain percentage, often tied to the strength of the market overall. In each case, the processing fee may be different because the processor is shouldering varying degrees of risk and reward. In none of the cases we reviewed did municipalities opt to skip the middleman and sell materials processed at their own MRF directly on the open market, although such cases do occur in smaller jurisdictions from time to time. Under these arrangements, the municipality's relationship to the recycled-materials market—and its revenues or losses—would take yet a different form.

The comparison of New York to its large cousins also shows that single-stream recycling, in which most or all recyclables are collected and processed together, is an emerging trend among large cities. Especially when paired with automated-collection systems that reduce crew size and increase collection speed, single-stream approaches appear key to making collection economics work, and this goes for cities that use municipal collection crews, as well as for those who contract out to private haulers. At the same time, the case of L.A. shows that single-stream processing can bring with it serious problems of contamination, which undermines marketability of processed materials. On the West Coast, the strength of markets and the available technology nevertheless make this approach work. It is far from clear, however, that the method is transferable to the East Coast context.

Although public education was not the focus of this comparison, research showed that the mechanisms a city uses for public education do not vary greatly from place to place—although who pays for them does. Cities like San Francisco and Seattle, in which residents pay direct fees for service, require contractors to foot some or all of the public education bill. County and state monies, furthermore, supplement public education budgets in most areas, making it very difficult to get a handle on variations in per capita spending. But a comparative examination shows the main vehicles for public education—speakers, school visits, mailings, billboards, TV spots, print advertisements, compost bin sales, and the like—are used across the board. Appendix IV details some of the incidental findings about comparative public education programs that were compiled during the research for this report. It argues that the lack of correlation between public education spending and diversion rate invites reconsideration of the conventional wisdom that public education frequency, forms, and/or spending is the primary determinant of the efficiency and effectiveness of a recycling program.[141] Certainly no recycling program can work without public education. But that does not mean that variations in diversion, costs, or other features of recycling among cities can be explained by different approaches to public education.

Finally, it should be clear that when the question of "what other cities are doing to make recycling work" comes up, it is not enough simply to turn to the official statistics at hand, or seek out success stories. These sources can be important starting points. Yet for a comparison of recycling programs to be of any use, comparisons must include much wider and more painstaking examination of a variety of factors. At a minimum, it is essential to establish comparability of municipalities in terms of population size, density, per capita waste generation, and housing stock. It is also important to pay attention to how a jurisdiction calculates its diversion rate. To comply with California's reporting requirements, for instance, Los Angeles calculates its diversion rate based on collected tonnages (including inerts, asphalt reuse, and C&D debris), processors' survey data, California Redemption Value data, C&D and yard trimmings survey data, generator surveys of source reduction, and alternative daily cover tonnages reported by survey of Los Angeles and Ventura County Landfills. This method is much broader and admits far more to diversion estimates that does New York City's method.

When diversion rates from other cities are reported in the media or in policy documents, they are commonly compared to NYC's diversion rate as we calculate it. For example, one *Newsweek* article that ran shortly after the temporary suspension of glass and plastic recycling in NYC invited readers to consider that "the City recycles only 18 percent of its trash, as compared to Los Angeles's 44 percent, Chicago's 47 percent and Seattle and Minneapolis, which recycle a whopping 60 percent of their trash."[142] Such comparisons are neither accurate nor useful.

Appendix I
STATE RECYCLING GOALS AND MANDATES

Table AI-1 State Recycling Goals and Mandates[1]

State	Mandate/Goal	Mandate?	Penalty?	Pre-/Post-Consumer Distinction?[2]
Alabama 	1989 law, Act No. 89-824, established a 25% waste-reduction and recycling goal. No due date for goal; no formal requirements for localities to report recycling information to state. Statistics on recycling unavailable, but there has been a dramatic increase in curbside and drop-off-center recycling. 1990 law, Act No. 90-564 requires all state agencies, schools (K–12), and public colleges and universities to implement recycling programs.	No	No	No
Alaska 	No laws imposing statewide recycling mandates/goals exist, only declaration from the governor encouraging recycling. In 2000, the Assembly adopted for Anchorage municipalities the following goals: 30% of population to recycle (21% currently recycle but is not mandated); 1% of tipping fees go towards funding recycling.	No	No	No
Arizona 	Title 49 contains recycling statutes; state has no established recycling goals; state monitors municipalities and counties and is responsible for engaging them in recycling and waste reduction.	No	No	No
Arkansas 	1991 law, Act 749, established recycling goals of 30% by 1995 and 40% by 2000. State met the 1995 goal and exceeded the 2000, 40% goal. The 1999 recycling rate was 44%.	No	No	No
California 	The Integrated Waste Management Act directs every jurisdiction to divert 50% of its waste stream for the year 2000. AB 2494, passed in 1992, requires a specific, standardized methodology to measure solid-waste disposal reduction. Each jurisdiction uses this methodology to summarize its waste-reduction progress in an Annual Report to the Board. AB 75, which added sections to the Public Resource Code, requires state agencies to meet waste-diversion goals of 25% by 2002 and 50% by 2004 and to document their efforts in meeting these goals. AB 939 (of the Integrated Waste Management Act) requires local governments to prepare and implement plans to achieve 50% waste reduction in 2000, to divert 25% of solid waste from landfills by January 1, 2002 and 50% by January 1, 2004. In regards to buying products, most must have both a 50% minimum procurement goal and 50% minimum recycled content.	Yes	Yes	No
Colorado 	No recycling laws, however, governor issued a challenge for citizens to divert 50% of the waste by 2000. 1991 law, HB1245, created an incentive for companies to recycle, giving them tax credits for equipment necessary for recycled materials. 1992 law, HB1318, created a recycling processing/manufacturing-loan and market-development program.	No	No	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
Connecticut 	1987 law, PA87-544, set 25% recycling goal by 1991. 1993 law, PA93-423, raised goal to 40% source-reduction in 2000. 1998–1999 recycling rate was 25%.	No	No	No
Delaware 	Solid Waste Authority Goal (SWA) to recycle and reuse 35% of household solid-waste discards by 2001; SWA resource-recovery goal, including energy from combustible solid waste, is 50% by 2001 and 70% by 2010.	No	No	No
Florida 	1988 law sets county recycling goals of 30% of all solid waste and 50% of each of five material groups (glass, newspaper, aluminum, steel, and plastic) by 1994. Counties with populations less than 50,000 are excluded from these requirements provided that they offer the opportunity to recycle. Most counties met 30% goal, however, no county met 50% goal in ALL given material groups. The recycling rate has increased from 4% in 1988 to 38% for 1997. The March 2000 estimated recycling rate was 40%. There are penalties for large counties that do not meet the 30% goal, and there is a distinction between pre- and post-consumer materials. In 1997, a bill passed awarding a $1.7 million innovative grant to one county (counties must compete for it).	Yes	Yes (cut off grant money and refuse permits)	Yes
Georgia 	1990 law, SB533, requires 25% recycling goal by July 1, 1996 per capita; 1993 law, HB257, updates the law requiring the state to reduce the amount of waste received by 25% by 1996. State did not meet 25% recycling goal, fell short at approximately 21%. State did not meet waste-reduction goal. Recycling rate in 1995 was 33%.	No	No	No
Hawaii 	Chapter 34G of the Hawaii Revised Statutes sets a 25% waste-reduction goal before 1995 (state did not reach that goal). A 50% goal by 2000 was set; state did not meet the 2000 goal and no penalty was, or could be, imposed. 1999 recycling rate was 24%.	No	No	No
Idaho 	No law, however, there is a nonbinding resolution that was passed encouraging state achievement of 25% waste-reduction goal. Legislation has given a 5% purchasing preference to those items meeting recycled-content standards..	No	No	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
Illinois 	State procurement code mandates that, whenever it is economically and practically feasible, 40% of the dollar amount of paper purchased by the state be recycled. The aggregate rate increased to 50% by July 1, 2000. For high-grade printing and writing paper to qualify as recycled, it must contain at least 50% recovered material, 30% of which must be post-consumer waste. Beginning July 1, 1998, the post-consumer–content requirement increased to 40% and again to 50% by July 1, 2000.	No	No (except for newsprint)	Yes (for newsprint and procurement)
Indiana 	Goal to reduce waste 35% by January 1, 1996; 50% by 2001; counties must make 20-year plans; state did not meet the 1996 goal; 1998 recycling rate was 21%.	No	No	No
Iowa 	1988 law established 25% waste-reduction goal by July 1, 1994 and 50% by July 1, 2000; 38 of 50 planning areas have met the 25% reduction goal and 2 of the 50 have reached the 50% reduction goal. 2000 goal was not met — recycling rate was 37%. After planning areas failed to meet the 1994 goal, the state offered a financial incentive. All waste-management–assistance programs and environmental protection programs involving waste are financed through a tonnage fee ($4.25 per ton collected at the landfill). 95 cents of this fee is normally retained at the local level for programs. The first incentive for the 25% goal offered an additional 50 cents to those planning areas that meet the goal. The second financial incentive required those who did not attain the 25% goal to send the state an additional 50 cents per ton, in turn making the difference in the amount retained by those who reach the 25% goal and those who do not, $1.00.	No	No (bottle bill)	Yes
Kansas 	1990 law requires counties to submit solid-waste–management plans to the Department of Health and Environment Bureau of Waste Management; no specific statewide recycling or waste-reduction goals. All counties have turned in required solid-waste–management plans and must do so annually. Some counties have no formal goals, others have goals as high as 50%. The Bureau released a new Solid Waste Management Report in December of 2000. Grant program established for recycling and other programs, which provides one million dollars a year to the recipient. The recycling rate for municipal solid waste in 1995 was approximately 11%. Actual quantification of the most recent recycling rate (1997) is difficult, but it is a few points higher than the 1995 rate.	No	No	No
Kentucky 	1991 bill, SB2, set a policy to reduce waste and set a goal of 25% by 1997. The state did not meet the 1997 goal and no new legislation has been passed.	No	No	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
Louisiana 	State law set goal of reducing waste landfilled by 25%; state has not met this goal. Recycling rates averaged approximately 15-17% in 2000.	No	Yes (no more than 20 cents per ton)	Yes
Maine 	1989 law set 50% recycling goal by 1998. This goal has been extended with no target date. Statistics are calculated in two sectors: community and commercial. Community sector achieved 43% in 1998. There is no penalty for not meeting this goal. Commercial sector rate has not yet been calculated, but will probably fall short of the goal as well. Legislation enacted to create a reasonable progress goal of 35%.	No	No	No
Maryland 	1988 law set 20% waste-reduction goal by January 1, 1994; 15% for smaller counties; all counties in the state met 1994 goals. In 1999, 36% rate was reached and goal was increased to 40%.	Yes	No	No
Massachusetts 	Commonwealth adopted a 46% recycling goal by 2000. The 2000 recycling rate is estimated to be 36%, triple that of 1990. 85% of population has the ability to participate in a comprehensive program. 2000 Solid Waste Master Plan has objectives to increase recycling efforts in areas where it is lowest (urban areas), provide grants for municipalities, and increase technical assistance.	No	No	No
Michigan 	1988 policy encourages by 2005: waste reduction by 8–12%, reuse rate of 4–6%, composting rate of 8–12%, recycling rate of 20–30%, waste-to-energy goal for incineration of 35–45%, and landfill rate of 10–20%.	No	No	No
Minnesota 	1989 law set a 35% recycling goal by December 31, 1996 for the Greater Minneapolis area, and a 50% recycling goal for the metro area. Source-separation plans are required for each SWM district. Every county must have one recycling center; all counties must recycle at least four items. 40% of waste was recycled in 1998 (46% with waste-reduction and yard-waste credits). Individual counties have set their own goals in the planning process.	No	Yes	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
Mississippi 	1991 law, SN2984, created authorities — nonhazardous-waste fee collection, 25% recycling goal by 1996. State has not met the original goal — the 2000 rate of recycling averages 11–12% statewide. There are no penalties for not meeting the goal; recycling is not mandatory.	No	No	No
Missouri 	1990 law, SB530, established a 40% waste-diversion goal by 1998. State increased the percent of solid waste recovered from 10% in 1990 to 26% in 1995 to 33% in 1996. Goal still stands at 40% for the state. There is no mandate to meet this goal and no penalties for nonachievement.	No	No	No
Montana 	1991 law established a 25% recycling goal by December 31, 1996. There are no reporting requirements, hence there are no estimations on recycling rates. A proposed rewrite of the Integrated Waste Management Act hopes to provide more accurate data on the states' recycling rate.	No	No	No
Nebraska 	1992 law, LB1257, sets 25% waste-reduction goal by 1996, 40% by 1999, 50% by 2002. State met 1996 goal. Some counties have met 40% goal and some have not. Since there is no tracking or requirement of reporting, the goals are not mandated.	No	No	No
Nevada 	1991 law, AB320, set a 25% recycling goal by 1995. The state did not meet the 1995 recycling goal but no penalties were imposed. Tire fee to fund recycling; counties must submit plans. 1995 law weakened the recycling requirement — municipalities and counties over 100,000, as opposed to 40,000 are required to provide curbside recycling. Statutes have been amended (for 2000 on) to include public buildings in recycling programs.	No	No	No
New Hampshire 	40% waste reduction for 2000 extended, but classified now as a diversion goal.	No	No	No
New Jersey 	1992 revisions to the recycling goals in the Recycling Act established a 50% municipal-solid-waste–recycling goal by December 31, 1995; and a 60% total recycling goal by December 31, 1996. State failed to meet the municipal-solid-waste–recycling goal of 50% in 1995. State did meet overall recycling goal, with a recycling rate of 61% in 1996. Law has not changed but policy decree raised the total recycling goal to 65% by 2000. NJAC7: 26A describes the state recycling rules.	No	No	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
New Mexico 	1990 law, SB2, sets 25% waste-diversion goal by 1995 and 50% goal by 2000; mandates solid-waste program by 1993; requires procurement of recycled products; state did not meet 1995 goal; in 1994, state at 12%; no penalties imposed.	No	No	No
New York 	1987 Solid Waste Management Plan established a 50% waste-reduction/recycling goal by 1997; not mandatory. 50% recycling goal is broken down into two categories: 8–10% waste-reduction goal and 40–42% recycling goal. The state has met these goals with a recycling rate of 42% in 1997 and 1998. Executive Order Bo. 142, issued January 21, 1998, required state agencies and public authorities to engage in certain recycling and waste-reduction practices, such as double-sided copying and the computerization of files.	No	Yes	Yes
North Carolina 	1989 Solid Waste Management Act established a 25% waste-reduction goal by June 30, 1993. State did not meet 1993 goal. 1991 law added a 40% waste-reduction goal by June 30, 2001. By June 1, 2001, each local government must have submitted a plan that includes a goal for the reduction of municipal solid waste and a further goal of continued reduction by 2006. 1998–99 recovery rates for different programs include 37% for curbside, 35% drop-off, 2% mixed waste, and 26% for other programs. The state reports an estimated overall recovery rate of 32% for 1998–1999 which includes two sectors: 1) the local government which provides an accurate diversion rate of 10%; and 2) the private sector which has data that is more difficult to calculate but has a high diversion rate of approximately 22%.	No	No	No
North Dakota 	1991 law established a 10% waste-diversion goal by June 30, 1995; 20% waste-reduction goal by June 30, 1997; 40% waste-reduction goal by June 30, 2000. State met 1995 and 1997 goals. 1999 had a 27% recycling/composting diversion rate.	No	No	No
Ohio 	Goal for waste reduction and recycling of municipal solid waste was 25% by 2000; 50% of industrial waste by 2000; and 50% for total waste (MSW plus industrial waste). In 1996, the most recent year of recycling rate calculations, the state recycled 42% of waste generated.	No	No	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
Oklahoma 	Oklahoma State Recycling and Procurement Act; no mandate, it is voluntary. State government agencies, entities, and schools receiving funding must create a waste reduction program, if it is economically feasible.	No	No	No
Oregon 	1991 law, SB66, set 50% recovery goal by 2000; mandates different recycling rates for different waste sheds; established minimum-content requirements for rigid plastic and glass containers, newsprint, and telephone directories; requires statewide solid-waste plan by 1994; created Recycling Markets Development Council. 1997 legislation directed counties to set new recovery goals equaling the greater of either the numbers in 1995 statutes or actual 1996 recovery rate — it was an effort to encourage counties to work towards the 50% goal. Oregon DEQ showed a 1998 recycling rate of 37.3%.	No	No	Yes
Pennsylvania 	1988 law, Act 101, required state to recycle 25% of municipal waste by January 1, 1997. 1997 goal was met. No new legislation, but the governor announced a new goal of 35% of municipal waste by 2005. 1998 recycling rates averaged 25.6% for the state.	No	Yes (civil and criminal)	Yes, postconsumer
Rhode Island 	1989 law established a 70% recycling rate with no deadline for achievement. Current recycling rate is approximately 15%. Regulations have changed. The state mandatory list of recyclables has been increased. New composting regulations require composting facilities to register with the state and create plans. Regulations have increased composting.	No	No	No
South Carolina 	1991 law, SB366 set a 30% waste-reduction goal and a 25% recycling goal by 1997. Recycling goal was met but waste reduction was not. In 1999, Bill 3927 increased the state recycling goal of municipal solid waste to 35% by June 30, 2005.	No	No	No
South Dakota 	HB1001 required the phasing in of certain landfill bans; communities may opt out through a referendum. Recycling goals were 25% by July 1, 1996 and 50% by July 1, 2001. The state met the 1996 goal. Recycling rate for 1997 was 42%. October of 1999 reported a source-reduction rate of 43%. Certain items such as yard waste, lead acid batteries, appliances, and waste motor oil are banned from landfills. Any other recycling is up to individual municipalities and is not mandated by the state.	No	No	No

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

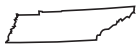
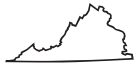
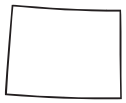
State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
Tennessee 	1991 law, HB1252, required a 25% per capita reduction in solid waste by December 13, 1995. In 1996, reduction rate was 22%. The recycling rate increased from 35% in 1995 to 37% in 1996. In 1995, the 25% solid-waste–reduction goal was extended until 2003.	No	No	No
Texas 	1991 law, SB1340, set a 40% recycling goal of solid waste by 1994; 1993 legislation, SB1051, amended it to become a waste-reduction goal; state did not meet the 1994 goal and no penalty was imposed. 1997 reporting estimated an average of 20% current waste reduction.	No	No	No
Utah 	No recycling laws/goals.	No	No	No
Vermont 	40% waste reduction goal after 2000. State expected to meet the 40% goal. 1998 recycling rate was 36%. 1993 law, SB51, established solid-waste districts that must adopt mandatory source-separation ordinances. Solid Waste Management Plan set a diversion goal of 50% by 2005.	Yes	Yes $1000 per violation	No
Virginia 	1989 law set a 10% recycling goal by 1991, 15% by 1993, and 25% by 1995. All goals were met; localities are recycling at an average of 35%. 1995 law requires localities to maintain a 25% recycling rate and have a solid-waste plan that specifies methods for maintaining the required 25% recycling rate. There are no longer reporting requirements for localities.	No mandate, but required solid-waste–management planning	No	No
Washington 	Mandatory recycling goal of 50% by 1995. Loans and grants available to local governments for waste reduction, recycling programs, composting, and education. Waste tax funding goals. Parks, airports, and marinas separate two recycling materials in 1993. Recycling litter tax now applies to by-products produced by some manufacturers and food processors (1992). Business waste tax on trash sent to landfills. Local governments could not institute bans, but the ban on bans was lifted in 1993. State did not meet 1995 goal — all funding ended in 1995 but goal still exists. Recycling rate for 1999 was 32.5%.	Yes	No	Yes, postconsumer

Table AI-1 State Recycling Goals and Mandates[1] *(continued)*

State	*Mandate/Goal*	*Mandate?*	*Penalty?*	*Pre-/Post-Consumer Distinction?[2]*
West Virginia 	1991 law established recycling goals of 20% by 1994; 30% by 2000; 50% by 2010. State did not meet 1994 goal and no penalty was imposed. The average recycling rate was approximately 13% for 1998.	Mandatory for cities above a threshold population and for counties that adopt a mandate provision.	No	No
Wisconsin 	No recycling goals. However, in 1989, Department of Natural Resources regulation (Chapter NR 544) set a standard for a recyclable collection measured in pounds per person per year. Recyclables include newspaper, magazines, aluminum, steel, bimetals, tires, plastic (no. 1 and 2), and glass containers and foam polystyrene packaging. In rural counties, each person should recycle 83.7 pounds per year. In other counties, 108.2 pounds per year. Due to market fluctuation, an exemption exists for recycling polystyrene. There is also a ban on oils, batteries, major appliances, and yard waste from landfills.	No	No	No
Wyoming 	There is no recycling mandate or requirement for municipalities, only guidelines to help the municipalities set up recycling programs.	No	No	No

1 Information in this table is reproduced from the website of the American Forest and Paper Association (www.afandpa.org) and may not reflect states' most recent data. In addition, states' interpretation of definitions of "goals" and "mandates" may differ.

2 Does the state distinguish between pre-consumer recycling (i.e., recycling of industrial scrap) and recycling of collected material after use? States without such distinction may have higher recycling rates since industrial scrap is routinely recycled as part of normal production processes.

Source: www.afandpa.org.

Appendix II
BEYOND CASE STUDIES: COMPARATIVE STUDIES OF RECYCLING RATES

Table AII-1 shows the costs per ton and diversion rates for DSNY-managed waste for fiscal years 2001, 2002, and 2003.

Table AII-1
Performance Statistics for the Department of Sanitation

	FY 01	*FY 02*	*FY 03*
Refuse cost per ton (fully loaded)	$243	$257	$242
Disposal cost per ton	$91	$106	$95
Recycling cost per ton (fully loaded)	$323	$305	$381
Paper recycling revenue per ton	$7	$7	$7
Annual tons recycled in total (000)	2,083	1,869	1,557
Annual tons disposed (000)	3,516	3,360	3,799
Curbside and containerized recycling diversion rate	20.10%	19.80%	11.40%
Total diversion rate	37.20%	35.70%	31.80%

Source: *Mayor's Management Report Preliminary Fiscal Year 2004*
www.nyc.gov/html/ops/downloads/pdf/2004_mmr/0104_mmr.pdf.

An obvious question is how do these costs and rates compare to those in other U.S. cities. The discussion of waste management in San Francisco, Los Angeles, Chicago, and Seattle in Chapter Three of this report covers some of the difficulties in making such comparisons. However, a number of studies have been conducted that use quantitative techniques to compare costs and diversion among large numbers of U.S. municipalities. This Appendix presents a review of three of the most important studies.

Cautions About Comparisons

Before reviewing any comparison, it is important to point out that there are serious limitations to comparing costs for recycling and waste disposal. These limitations have been acknowledged by a wide range of experts in the solid-waste–management field:

Editor of *Resource Recycling*, Jerry Powell

> There's a big lack of top-quality information on the net benefits of recycling, in particular, a dearth of well-researched cost data.[1]

City of Tucson, Recycling Coordinator

> We don't really report on costs per ton. We talk big numbers in big circles. Per ton collection costs aren't everyday information. They are hard to track, and usually vary with the administrator who calculates them at the time, as opposed to the private collection costs which are always known.[2]

City of Los Angeles, Joint Labor-Management Committee, Collections Planning Group, writing in 2000:

> …regional economic variations [do] not permit credible comparisons [among cities' waste management systems]. Disposal costs, which vary regionally, significantly influence total costs. Some agency resources come primarily from their City's general fund, while others rely only on enterprise funds.…Some agencies [use] cost data based upon 1988 data, while in other cases...information is more current.…Most importantly, there is no template guaranteeing that the financial information from the agencies is collected and/or computed in the same manner as to permit credible comparisons.[3]

Waste News, February 14, 2000, "Apples and Kumquats"

> Cities' recycling programs vary as widely as the cities themselves.…Municipalities are figuratively as well as literally all over the map when it comes to recycling…the apples-to-apples comparison of city recycling rates remains elusive.[4]

The three studies reviewed present program costs comparatively, but should be interpreted with these limitations in mind.

The Research of David Folz

Political scientist David Folz uses quantitative techniques to assess the cost-effectiveness of municipal recycling programs in the United States, analyzing survey data on large numbers of municipalities over time. Folz takes into account a wide range of variables that reflect demographic, political, economic, fiscal, technological, and participatory aspects of solid-waste management in cities and towns.[5] Using statistical techniques, he isolates factors that explain variation in a number of program outcomes—including participation and cost-effectiveness of recycling in comparison to landfilling.

One of Folz's more recent works is a 1999 article in *Public Administration Review* in which he argues against recycling's "perennial critics [who] challenge the economic prudence and environmental benefits of recycling."[6] This article goes on to identify features associated with high diversion, as well as to determine circumstances in which recycling is more cost-effective for municipalities than disposal.

Diversion

Comparing survey results from 1989 to 1996, Folz finds that diversion rates in U.S. municipalities rose across the board from an average of close to 16 percent in 1989 to 33 percent in 1996—confirming the widely observed trend of escalating diversion rates throughout the U.S. during the 1990s. Folz observes that this increase was higher among mandatory programs (close to 23 to 36 percent) than voluntary ones (nearly 13 to 30 percent). More marked increases have also occurred among programs that collected "tin" (bimetal) and other metals, and had a full-time recycling program coordinator.

Folz's results confirm the importance of composting in boosting diversion. He observes that diversion increased more among localities "that composted yard wastes instead of disposing of these in the landfill or incinerator."[7] Diversion rates have increased in cities all over the nation since the late 1980s. In recent years, most of the increase has come from yardwaste diversion.

Moreover, he notes an inverse relationship between density and diversion, writing that "cities with high population densities experienced less improvement in diversion. This suggests that local officials in these cities faced special challenges in collecting recyclables from high-rise residential...generators."[8] This research confirms the difficulties of attaining high diversion in high-rise residential buildings.

Costs

Folz also looks at changes in solid-waste–program costs over time, finding that in large cities, overall waste-management costs for disposal, composting, and recycling combined have fallen. Folz cites an overall decrease in costs per ton for recycling, composting, and refuse combined from $109 per ton in 1989 to $95 per ton in 1996 (in constant dollars).[9] In cities with populations over 100,000, furthermore, this drop has been more marked—total costs fell from $164 to $81 per ton, on average.[10] He also gives evidence to show that over this period, average recycling costs have become competitive with disposal. Cities earned an average of $36 per ton of recyclables in 1996, which rendered their net costs for recycling/composting collection, processing, and other associated items (administration, education, etc.) on average $68 per ton. In contrast, refuse collection and landfilling averaged $134 per ton for that same year.

However, Folz finds that in very large cities, recycling is not as cost-competitive as in smaller jurisdictions. In the largest cities surveyed (those with populations over 100,000), revenues from recycling were lower than average—around $15 per ton (Table AII-2, page 130).

Key Findings in the Research of David Folz

Diversion Rates 1989 to 1996

Diversion rates have increased

- More in cities with mandatory programs
- More in cities that collect bimetal cans
- More in cities that have a full-time coordinator
- Mostly due to the additional diversion from yard-waste composting

Diversion and Density

- Cities with high density experience lower diversion rates
- Cities with concentration of multifamily apartment buildings experience lower diversion rates

Waste-Management Costs in the Largest Cities

Cities with populations over 100,000

- Saw more of a drop in *total* waste-management costs over time than smaller cities
- Earn less revenue per ton on recyclables than smaller cities
- Have higher unit costs for recycling due to presence of multi-unit households

What Drives Recycling Costs

Recycling costs are lower when

- The recycling program is voluntary, not mandatory
- The recycling program includes yard-waste collection

Recycling costs are higher when

- Refuse is collected the same day as recycling
- Multifamily generators are included in the recycling program
- Cities have a population over 100,000

Diversion-rate increases have tiny effects on recycling costs.

Population and Housing Density Mitigate Economies of Scale

Diversion rates are lower and recycling costs are higher

- In large, high-density cities
- When multifamily dwellings are included in a city's recycling program

Folz does not measure large savings from increases in tons diverted

Research Note

Folz notes that there are serious limits to even the most careful comparative research on recycling costs.

Table AII-2
Mean Net Recycling Costs Per Ton and Mean Costs Per Ton for Refuse Collection and Disposal in 1996 (actual dollars)

Population	*Recycling costs/ton*	*Recycling revenue/ton*	*Net recycling costs/ton*	*Refuse collection costs/ton*	*Refuse disposal costs/ton*	*Total refuse costs/ton*
Under 5,000	$158.14	$24.46	$133.68	$81.51	$68.82	$150.33
5,000–10,000	$119.02	$12.84	$106.18	$145.45	$57.96	$203.41
10,001–25,000	$92.86	$19.31	$73.55	$48.50	$52.75	$101.25
25,001–50,000	$48.10	$16.16	$31.94	$120.05	$40.79	$160.84
50,001–100,000	$48.77	$17.51	$31.26	$46.11	$43.37	$89.48
100,000 plus	$88.02	$14.75	$73.27	$53.54	$34.96	$88.50
All cities	**$103.63**	**$35.67**	**$67.96**	**$81.99**	**$51.83**	**$133.82**

Source: David H. Folz, "Municipal Recycling: A Public Sector Environmental Success Story," *Public Administration Review,* July/August 1999, Vol. 59, No. 4.

The discrepancy between net recycling costs ($73) and refuse collection/disposal ($89) was less in large cities as well. Further analysis leads Folz to suggest that "the inclusion of multi-family households appeared to contribute to higher unit costs [for recycling]."[11]

Using regression analysis, Folz identifies factors that explain variation in recycling costs across cities. Programs with voluntary recycling pay about $59 dollars less for recycling collection and processing per ton than do mandatory programs. When a program includes yard waste, its recycling/composting costs average about $53 lower than when the program only collects recyclables. Collecting recycling on the same day as refuse—a factor that he stresses is important to boosting diversion—increases per ton costs by an average of $57 per ton. Including multifamily generators in a city's curbside program (all or some) increases recycling costs by $39 a ton.

Folz also observes that with each ton recycled, per ton costs fall by an average of 2 cents. The total tonnage a city recycles, of course, depends on its population. Depending on the size of the city, this savings will add up differently, but the effect is tiny in all cases. For instance, if New York City were to double its pre-suspension tonnage of residential recycling (665,000 tons per year in Fiscal Year 02), this model predicts it would save a total of only $13,000 per year.[12]

Research Limitations

Overall, Folz's research suggests that in certain circumstances, a municipality's net costs for collection and processing recycling may be less than those for refuse collection and disposal, although on average less so for large cities. But he also acknowledges limitations to his method of generating cost estimates, in which:

> …recycling program costs were measured by the recycling coordinator's response to the question, 'What was your city's *total cost* (all direct and indirect costs) for the recycling program, excluding any revenue from material sales.'[13]

> …accurate, precisely comparable, and centrally collected cost data are not readily available.…Larger cities [may] collect and maintain extensive records on recycling costs. By contrast, some jurisdictions may not even have a separate line-item for recycling in their solid waste collection budget. Still another problem is the reluctance of some jurisdictions to share this information because they fear unfair comparisons in the absence of a standard, widely used method to calculate costs.[14]

Folz describes the uncomfortable choice that researchers in this area face: they must "neglect any cost comparisons, or employ reasonable measures, no matter how imperfect."[15] He stresses that "ascertaining the costs of recycling is...difficult," because "there is considerable variation in the extent to which local officials track recycling expenditures."[16] In fact, "total program cost" for recycling is an extremely variable measure because it depends very much on which items are included in the recycling budget. Some jurisdictions count collection as part of their overall solid-waste budget and calculate recycling costs as processing and public education only. Some track the very minor spending on contract administration and publicity overseen by the city as the "recycling budget." Many costs may never be officially recorded. And the fact that only 105 out of 158 cities surveyed in 1996 supplied financial data at all suggests it may be possible that "*some* coordinators may not know what their recycling program actually costs,"[17] while others keep these costs in their heads only.[18]

Furthermore, Folz explains that he was not able to consider a number of program design parameters that affect a city's collection, processing, and marketing operations, including the specific materials collected, crew sizes/configuration, types of collection vehicles and routes, collection frequency and schedule, and types of generators included in the program.[19] "All of these factors merit analysis," he observes, even if the limits of his study preclude consideration.[20]

Folz concludes that although recycling should not be expected to "pay for itself," there are different circumstances in which recycling will be more or less expensive. He also observes that despite the fact that recycling, under the right conditions, can be less expensive than disposal, recycling in general "is not cheap."[21] Thus this research by no means settles the matter of comparative costs—even though it does provide an interesting analysis of the program factors that are significantly correlated with reported program costs.

What Can We Learn from Folz's Research?

With good reason, Folz's research is widely cited in the policy advocacy literature to argue for recycling program development and expansion. For example, a Year 2000 report issued by the Consumers Union summarized the results of his work, saying:

> A recent study of municipal recycling performance in 158 cities compared recycling costs to solid waste collection and disposal costs and found that 'the cost per ton declined as city size and number of tons increased' (Folz, 1999, p. 343). Such economy of scale clearly benefits NYC recycling programs.[22]

It is important to assess Folz's work in its entirety, and not just cite parts of it that sustain a particular argument. Folz's overall work clearly shows that very large, high-density cities with multifamily dwellings will incur higher costs than other demographic areas—mitigating economies of scale. And while his research bears out the assumed inverse relationship between diversion and overall costs, it shows the magnitude of such a relationship to be tiny in dollar terms. Thus it invites a reconsideration of the conventional wisdom that envisions large savings potential from increasing the diversion rate in New York City.

The EPA/U.S. Conference of Mayors Report on Multifamily Recycling

In 2001, the United States Conference of Mayors, working in collaboration with the EPA, released a comprehensive, national study *Multifamily Recycling*. Unlike other studies of this topic, the EPA report paid close attention to costs and diversion. As the report pointed out, "multifamily recycling is often overlooked by public sector planners,"[23] and when it is examined, attention is usually focused on case studies of successful buildings, without regard to costs or diversion for a city's total housing stock of this type.[24]

According to this report, multifamily recycling receives less attention than programs serving single- and two-family houses because "multiple dwelling units are often considered part of the commercial sector, and many local governments have little control over [this] sector."[25] Furthermore, "where refuse is collected under individual contracts between landlords and competing private firms, recycling is often similarly unregulated."[26] This trend in categorization means that "at present, no universal definition of what constitutes a multifamily recycling program exists."[27] It may also explain, say the report's authors, why there is a perception that apartment dwellers are less likely to participate in recycling programs than are single-family dwellers.[28]

"Nonetheless," observes the EPA, "many communities have established and maintained successful multifamily recycling programs."[29] The EPA measures success using a dual criteria of effectiveness and efficiency, noting that "a program can be very effective (i.e. high diversion rate) and not very efficient (i.e. high unit costs). Obviously, the most successful programs are those that are both effective and efficient, or those characterized by high diversion rates and low unit costs."[30]

Data for this report was gathered via a survey in 1997 administered to recycling program managers of cities belonging to the U.S. Conference of Mayors with populations over 25,000. Among the 227 cities who responded, approximately half (118) had a multifamily recycling program in place for at least 12 months. The analytical portion of the study focused on a sample of 40 communities taken from the 118, selected to be representative of the U.S. as a whole in terms of geography and size.[31] Using data from these 40, the EPA calculated summary statistics on diversion rate, program costs, and other features, and ran tests to determine statistically significant relationships among these variables. For the purposes of the study, multifamily dwellings were defined as having three or more units.[32]

New York City was one of the 40 cities included in the analysis. This posed a problem for some of the statistical calculations, because of New York's disproportionately huge population. The report explained that "in some cases, where averages are calculated for all 40 communities, NYC's statistics are omitted to avoid skewing the data."[33] In fact, the report observed that out of a total of 11.5 million multifamily households in the entire U.S., 28 percent were in New York.[34]

Diversion

The overall diversion rate is one of the most widely reported statistics on municipal-solid-waste management, but multifamily diversion is rarely tracked separately. As the EPA notes, "multifamily refuse is frequently collected in the same trucks and on the same service routes as large commercial customers….Indeed, many communities did not have data on their collected amounts of multifamily refuse or recyclables."[35] Thus, much of the data used for the analysis was drawn from recycling coordinators' *estimates* of the multifamily fraction. The

EPA notes that in "only a minority of cases are separate data available for multifamily recycling tonnages."[36]

Using these estimates, the report calculated an average diversion rate of 14.6 percent for multifamily-dwelling curbside programs, with a range of 5 to 37 percent. When drop-off recycling was included, the average multifamily rate increased to 15.7. Among the 40 cities, the distribution across rates was roughly even: thirteen (13) had rates lower than 10 percent; sixteen (16) diverted between 10 and 20 percent; and eleven (11) exceeded 20 percent. (It should be noted that unlike many other diversion-rate comparisons, this report separated composting, as well as construction and demolition material out, focusing on metal, glass, plastics, paper, and other "traditional" recyclables as diversion from the residential stream to make comparisons.)

The study examined differences in costs and program characteristics among these samples to determine relationships between diversion and other factors. It noted that among high-diversion, multifamily recycling programs, 61 percent used dual-bin refuse/recycling trucks; 90 percent made recycling mandatory; 64 percent provided bins; and 63 percent charged for refuse and recycling collection, with volume-based incentives for refuse minimization.[37]

The authors also found several surprising results. The first was that:

> …there is a positive relationship between number of setouts (i.e. sorts) required and the diversion rates achieved. The programs with the highest diversion rates

Key Findings in the EPA/U.S. Conference of Mayors Report on Multifamily Recycling

Population

- In 1997, only half of U.S. cities with populations of 25,000 or more even had a multifamily recycling program
- New York City is home to 28 percent of the nation's multi-unit housing

Diversion

- In the year of the EPA study (1997), multifamily diversion averaged 14.6 percent nationwide
- Multifamily recycling is more complicated, more expensive, and tends to have lower diversion rates and higher contamination rates than single-family recycling...*nationwide*
- Over 80 percent of multifamily recycling programs were managed privately. Those programs reported higher diversion rates than publicly run programs.
- Surprisingly, this study found that multifamily generators achieved higher diversion rates when they were required to sort materials into more separate categories

Diversion rates are higher in multifamily programs that

- Use dual-bin trucks to collect refuse and recycling
- Have mandatory recycling programs
- Charge building owners volume-based fees for refuse and recycling collection

Contamination

Contamination is a frequent problem in multifamily recycling

- 80 percent of multifamily recycling coordinators consider it a "problem they have to live with"
- Methods to address contamination include suspending service, writing letters, installing surveillance cameras, and issuing fines

Costs

- Recycling costs are higher for programs serving multifamily units by an average of $50 per ton
- In programs that serve multifamily units, as well as those that don't, it costs more to recycle than to dispose of refuse
- Recycling costs were about $64 per ton higher in cities that had diversion rates under 20 percent; refuse disposal costs in those cities were about $23 per ton lower
- The larger the total quantity of materials to collect, the higher the program costs

Research Note

Multifamily recycling is an understudied area of research. In fact, many cities include multifamily buildings with commercial generators, and focus only on single- and two-family dwellings.

> average 3.2 setouts, while programs with the lowest diversion rates average 2 setouts…it appears requiring multifamily households to place their recyclables in 3 or more containers…is positively associated with increased diversion.[38]

This result was counterintuitive. In most studies, the number of setouts is inversely related to diversion because it makes recycling more complicated. The report ventured that there might be "a correlation between the number of materials collected and the number of setouts, and accepting many materials is a key element of achieving a high-diversion rate."[39]

The EPA also observed that "contamination...is a frequent problem in multifamily recycling."[40] A full 80 percent of all multifamily recycling program coordinators reported that they considered contamination as a problem to be lived with.[41] Most often, multifamily programs suspended service or left materials at curbside when contamination was especially bad, although among high-diversion communities, none refrained from collecting recycling when workers noticed contamination.[42] Instead, high-diversion communities used methods such as sorting samples of recycling materials to identify offenders, writing letters to "problem" apartment complexes, and even placing cameras in problem areas (methods reported among 11 percent, 11 percent , and 22 percent, respectively). In addition, 60 percent of high-diversion communities issued fines, as opposed to only 20 percent of low- and medium-diversion groups.[43]

The report also found that low multifamily participation rates were more frequently cited as a problem in communities with high overall diversion rates, than in low-diversion communities.[44] This counterintuitive result may have been due to increased sensitivity to low participation among high-diversion communities.

A final finding of the study was that multifamily programs with higher reported diversion rates were more likely to rely on a private firm to collect recyclables, and to award one private firm the exclusive right to collection.[45] Noted the authors, "there is a basic differentiation between services provided by employees of local government…and services provided by employees of a private firm."[46] In fact, among the multifamily programs examined, a full 82 percent had at least some form of private collection.[47] In contrast, only 32.5 percent of the communities provided any form of public sector recycling collection for multifamily complexes.[48]

Costs

The report's authors calculated the following mean, minimum, and maximum per-ton costs for recycling and refuse collection among multifamily and single-family programs (Table AII-3).

Table AII-3
Single vs. Multifamily Collection Costs

	Recycling collection costs per ton			***Refuse collection costs per ton***		
	Minimum	***Mean***	***Maximum***	***Minimum***	***Mean***	***Maximum***
Multifamily	$62	$177	$622	$16	$63	$171
Single family	$11	$127	$420	$16	$69	$286

Source: Multifamily Recycling: *A National Study,* EPA-530-R-01-018, November 2002, conducted by the U.S. Conference of Mayors and Ecodata, Inc.

Multifamily recycling costs exceeded single-family recycling costs by an average of $50 per ton. And in comparison to refuse collection, both multifamily and single-family recycling were more expensive. Unlike other studies of overall costs, this report found recycling collection to consistently outweigh refuse collection by substantial amounts.

Furthermore, the analysis revealed that "in multifamily recycling, collection costs per ton tend to decrease as the tons to collect at each stop increases."[49] On average, per-ton recycling-collection costs were $113 for cities with greater than 20-percent diversion, as opposed $177 in low-diversion groups."[50] Such savings were, however, partially offset by greater refuse-collection costs in high-diversion cities ($66 per ton, on average) as opposed to low-diversion ones ($43 per ton.)

The amount of material present at each stop on a collection route was documented as one of five factors determining overall program costs. These five factors, according to the report's literature review, account for 85 percent of the variation in costs of refuse- or recycling-collection programs nationwide (Table AII-4).

Table AII-4
Major Determinants of Cost Variation

Factor	*If a city has*	*Overall program costs will be*
Economic	higher prevailing wages	higher
Geographic	denser housing per curb mile (if this results in less time travelling between stops)	lower
Demographic/income	greater amount of material set out	lower
Scale of operations	larger the total quantity of materials	higher
Frequency	more often	higher

Source: Multifamily Recycling: *A National Study,* EPA-530-R-01-018, November 2002, conducted by the U.S. Conference of Mayors and Ecodata, Inc.

As the amount of recycling or refuse collected at each stop goes up, collection costs per ton for that material tend to go down. In addition, housing density may decrease collection costs *if* it means decreased travel time for collection trucks. However, this effect may not be seen when housing density translates to increased local traffic and street parking. It is notable that an overall larger scale of operations does not yield economies; "the larger the total quantity of materials to collect, the higher the program costs."[51]

What Can We Learn from the EPA's Multifamily Recycling Report?

The EPA findings suggest that, on average, multifamily costs for recycling collection outweigh those for single-family service. This discrepancy is compounded when the scale of the program is large, and when the prevailing wage is higher. Higher diversion rates do tend to drive recycling collection costs down for both multifamily and single-family dwellings, but in such cases multifamily still remains a more costly undertaking.

Multifamily diversion is, in fact, most economical when collection is privatized. However, this effectiveness comes at a price:

> …multifamily recycling programs can present a challenge for funding. In those communities where multifamily refuse collection is considered a service to be paid for by the apartment complex, typically through a contract between the property manager and a private hauler, there is no governmental expenditure for solid waste services to this category of customers. Implementing a recycling program to these customers, via any system except mandated subscription service, typically requires government funding.[52]

To offset this burden, governments may charge recycling fees to consumers directly or indirectly through contracts. The report states that "higher fees and a greater likelihood of a fee for multifamily recycling is associated with higher diversion rates."[53] But there are tradeoffs to such an approach since "charging units to recycle is often politically difficult to justify."[54]

Overall, the report finds that multifamily recycling is more complicated, more expensive, and tends to have lower diversion rates and higher contamination rates than single-family recycling. Multifamily buildings use common recycling areas, lack storage space in apartments, and possess an anonymity that single-family houses do not. Moreover, "costs of a program…are dependent upon factors that are both within and beyond the control of local government officials. Population density, prevailing wages, weather patterns, and income levels can affect travel times between collections stops, quantities of materials set out at each stop, operation of vehicles…and the basic cost of a collection crew."[55]

As with Folz's research, this report suggests that self-reported survey data on program costs and diversion has limitations, and should be regarded as an indicator of general tendencies rather than a precise quantification of program efficiency or effectiveness. This is true even when quantitative methods are used. The EPA used survey estimates of program costs, and were not able to check the determinants or comparability of such estimates. Recycling coordinators in many instances estimated multifamily diversion without recorded tonnages. Overall, the report's authors cautioned that because "no universal definition of what constitutes a multifamily recycling program exists," the very concept under study was somewhat indeterminate.[56]

EPA Report "Cutting the Waste Stream in Half: Community Record Setters Show How"

In contrast to the two survey studies profiled above, the EPA's 1999 report entitled *Cutting the Waste Stream in Half: Community Record Setters Show How* profiles a series of localities that have achieved high-diversion rates (45 to 60 percent), drawing overall conclusions about what constitutes a blue-ribbon waste-reduction program. This report, which was based on research by the Institute for Local Self-Reliance (ILSR), profiles 18 localities, chosen to represent a demographic cross-section of the United States. Populations range from 1,900 persons to 873,000; densities vary as well. The 16 municipalities and two counties range from urban to suburban to rural. They are spread throughout the U.S., representing 12 states. They exhibit different mixes of public vs. private-sector service provision, as well as variation in how service is funded (including 11 instances of pay-as-you-throw arrangements). While all but one consider curbside collection the "heart" of their program,[57] they differ in terms of the use of carts vs. bags; truck compartments and sizes; and manual, semi-automated, or fully automated collection. While most collect the standard array of recyclables and yard waste, some include additional materials. The programs vary in terms of how many segregations are used, how often recyclables are

collected, whether the program is voluntary or mandatory, as well as whether and how multifamily households are served (Table AII-5).

Diversion

The ILSR examines residential diversion separately from commercial diversion. In addition, it treats diversion through yard-waste composting and diversion through recycling of paper, metal, glass, and plastic as distinct. While the report's authors do count Bottle Bill redemptions in this "recycling diversion" rate (unlike NYC), they exclude "non-municipal waste items such as construction and demolition debris and used motor oil," from the diversion-rate calculation, as in NYC.[58] Source reduction is calculated as adding to the diversion rate only in cases in which "creditable data on the amount of material recovered through these programs were available,"

Table AII-5
Comparison of Record-Setters' Programs

Cities	*Participation rate*	*Materials targeted*	*Collection frequency for recycling*	*Segregations required*	*Participation mandatory*	*Fines*	*Pay as you throw*	*Average fee per year (as of mid-1997)*	*Private/public collection*	*Recycling collection crew size*	*Bins provided*
Visalia, CA	100%	20	weekly	1	no	no	no	N/A	public	1	yes
Fitchburg, WI	98%	25	weekly	4	yes	yes	yes	$82	both	1	yes
Madison, WI	97%	17	weekly	4	yes	yes	no	N/A	public	1	no
Loveland, CO	97%	19	weekly	3	no	no	yes	$52	public	2	yes
Ann Arbor, MI	93%	31	weekly	3	yes	yes	no	N/A	both	1	yes
Bellevue, WA	90%	29	weekly	4	no	no	yes	$156	private	1	yes
Seattle, WA	90%	23	varies	2 to 3	yes	no	yes	$192	private	1	yes
Falls Church, VA	90%	21	weekly	4	no	no	no	N/A	both	1	yes
Crockett, TX	80-90%	25	weekly	3	yes	yes	no	N/A	public	2	no
Clifton, NJ	80-85%	20	1x/3 weeks	7	yes	yes	no	N/A	both	3	no
San Jose, CA	83%	23	weekly	5	no	no	yes	$168	private	1	yes
Portland, OR	81%	22	weekly	varies	no	no	yes	$210	private	varies	yes
Chatham, NJ	80%	24	2x/month	5	yes	yes	yes	$117	both	3	no
Dover, NH	74%	28	weekly	3	no	no	yes	$57	private	1	yes
Ramsey Co., MN	62%	varies	2x/month	5	yes	varies	yes	$156	private	1	yes
Bergen Co., NJ	varies	N/A	varies	varies	no	varies	some	N/A	varies	N/A	varies
Leverett, MA	N/A	25	no curbside	N/A	yes	no	yes	$72	public	0	no
Worcester, MA	N/A	24	weekly	3	yes	no	yes	$26	both	1	yes

Source: Institute for Local Self-Reliance for the Environmental Protection Agency, *Cutting the Waste Stream in Half: Community Record Setters Show How,* EPA-530-R-99-013, June 1999.

and even then adding it to the composting rate, not the recycling rate.[59] Given the way that diversion is usually reported, these are important adjustments. As the report authors note, using these methods "lowered calculated waste reduction levels, ensuring our reported recovery levels would not be considered inflated."[60]

Using this methodology, the *recycling* rate (i.e., diversion of metal, glass, plastic, paper, textiles, and other materials but excluding yard waste) among the "Beyond Fifty-Percent" record-setters turns out to range from *16 to 40 percent,* with both a mean and median of 24 percent (Table AII-6).

Costs

The authors of the ILSR report acknowledge the difficulty of examining capital expenditures, operating costs, and materials revenues comparatively across jurisdictions:

> Evaluating the economics of community materials recovery programs is a challenging task. Reliable and consistent data are often lacking. Publicly funded programs may underestimate their costs by

Table AII-6
Comparison of Record-Setters' Diversion Rates

Cities	*Waste stream*	*Annual waste tonnage*	*Reported waste reduction*	*Yard-waste diversion*	*Reported recycling diversion*
Ramsey Co., MN	Combined	673,398	47%	8%	40%
Dover, NH	Residential	9,462	52%	17%	35%
Leverett, MA	Residential	652	53%	23%	31%
Ann Arbor, MI	Residential	47,943	52%	23%	30%
Fitchburg, WI	Residential	4,147	50%	21%	29%
Seattle, WA	Combined	288,106	49%	20%	29%
Worcester, MA	Residential	57,573	54%	27%	27%
Bellevue, WA	Residential	39,186	60%	34%	26%
Falls Church, VA	Residential	6,665	65%	40%	25%
Portland, OR	Combined	172,830	40%	17%	23%
Chatham, NJ	Residential	8,007	65%	43%	22%
Crockett, TX	Residential	2,711	52%	32%	20%
Loveland, CO	Residential	17,973	56%	37%	19%
San Jose, CA	Combined	433,576	45%	26%	19%
Bergen Co., NJ	Combined	353,815	49%	32%	17%
Madison, WI	Residential	88,583	50%	34%	16%
Visalia, CA	Residential	50,806	50%	33%	16%
Clifton, NJ	Combined	54,211	44%	28%	16%

Source: Institute for Local Self-Reliance for the Environmental Protection Agency, *Cutting the Waste Stream in Half: Community Record Setters Show How,* EPA-530-R-99-013, June 1999.

> including large volunteer efforts or excluding expenditures made by other public agencies, while private operations' data are often unavailable for public scrutiny.[61]
>
> …we have made a concerted effort to use a uniform methodology for documenting and assessing costs. Yet, due to the difficulty in gathering reliable and consistent cost information, the figures presented have some limitations.…Differences in local costs of living and market conditions, and service levels offered by programs all have financial consequences. Local factors affect fuel costs, labor costs, and tip fees.[62]

With these problems, the authors are extremely cautious about the application of their data, even going so far as to say that:

> …We do not believe cost data presented in this report should be used to make comparisons among communities regarding the relative cost-effectiveness of their programs.[63]

Key Findings in the EPA Report "Cutting the Waste Stream in Half"

Even "record-setting" communities have a diversion rate around 25 percent for paper, metal, glass, and plastic. The rest of diversion comes from other sources

The report by the Institute for Local Self-Reliance shows that "cutting the waste stream in half" depends mainly on the degree of yard-waste composting a municipality conducts.

Research Notes

- Unlike most studies, the ILSR report looks at paper, metal, glass, and plastic diversion separately from yard waste, other organics, or C&D.
- Even the most painstaking research on costs yields incomplete numbers that are not comparable across localities.

Nonetheless, the report does compare costs among municipalities by examining the change in overall solid-waste–management costs for a municipality before, and several years after, introducing recycling and composting in constant dollars. Authors calculate the total costs of each municipality's refuse, recycling and composting operations, including expenditures on administration, education and publicity, enforcement, collection, processing and marketing (for recyclables and compost, net of revenue), transfer and tipping (for refuse), and transportation, then divide this total by the number of households to get a per household cost for waste management.

Using this method, they find that in half of the municipalities for which there were adequate data, overall solid-waste–management costs *rose* as a result of the introduction of recycling, although in four of the seven cases of rising costs, landfill tip fees escalated during the same period in which recycling was phased in.[64] Thus, they argue, when the introduction of a recycling program coincides with increasing costs for solid waste management in general, the increasing expenses of refuse disposal, and not recycling, are often to blame. Furthermore, they find several cases in which overall solid-waste–management costs went down after the implementation of a recycling and composting program.

The ILSR's method of cost estimation surpasses that of Folz or the Conference of Mayors Report in that it entails more than a survey question about the "overall recycling budget," addressed to the municipality's recycling coordinator. Instead, the ILSR gathers separate estimates of capital and operating expenses, offsetting them with data on revenues from materials sales.[65] Whenever possible, they categorize costs for recycling and composting among administration, education/publicity, collection, and processing; and break down refuse costs into administrative, collection, transfer, and tip fee categories. Still, the authors concede that there are limitations on the data:

> …the costs documented focus on the costs of trash management and waste reduction incurred by the local government or community profiled or fees for services paid by…residents. [They do not include] the value of services, such as technical assistance, provided to localities by counties and states.…In addition, costs of capital equipment are reflected in debt service or depreciation costs, regardless of the source of funds used to purchase equipment.[66]

The authors explain that full-cost accounting techniques, in which each and every direct and indirect cost of all aspects of a solid-waste–management program are quantified, would be required to accurately "document and compare these record-setting communities," but recognize that "such research and analysis were beyond the scope of this report."[67] Thus the cost data in this study, as in all others, must be viewed as, at best, a general indicator of tendencies, and not a precise calculation:

> Communities account for and track their costs very differently. Some expend much effort to include all indirect and administrative overhead costs; others exclude these entirely. Some use accrual accounting techniques, others rely on cash-flow accounting.[68]

The ILSR reports the costs of recycling, composting, and refuse management separately on a per-ton basis. When feasible, overall costs are broken out into collection, processing/disposal, administrative, education-related, and other *ad hoc* categories. This exercise reveals a number of instances in which recycling costs are reported as lower than refuse disposal costs, as well as other cases where the reverse is true (Table AII-7).

Yet the methods with which each municipality tracks and reports costs differ so widely that the comparisons presented in this chart do not convey most of the information needed to interpret them. All of these communities have high overall diversion rates, and good recycling rates—yet their costs vary widely. Regional differences in the landfill market may explain why tip fees are higher for some cities than others, but clearly a much larger panoply of factors is at play in causing this variation.

What Can We Learn from the ILSR's "Cutting the Waste Stream in Half"?

The ILSR report shows that "cutting the waste stream in half" depends mainly on the degree of yard-waste composting a municipality conducts. With few exceptions, the "community record setters" profiled have recycling diversion for paper, metal, glass, and plastic that are in the 20- to 30-percent range. The report furthermore confirms that the costs of waste management—including refuse collection and disposal; and recycling collection and processing—vary widely even among the best performing programs, confirming the findings of Folz and the Conference of Mayors.

Table AII-7
Comparison of Record-Setters' Program Costs

Cities	*Refuse collection & transport per ton*	*Landfill tip fees per ton*	*Recycling collection per ton*	*Recycling total costs per ton**	*Recycling revenues per ton*
San Jose, CA	$59	$28	$62	$206	$0
Portland, OR	$58	$63	$124	$196	$0
Crockett, TX	$25	$13	$14	$189	$17
Madison, WI	$104	$34	$115	$160	$13
Bellevue, WA	$106	$66	$129	$139	$0
Loveland, CO	$68	$10	$112	$128	$11
Seattle, WA	$86	$45	$91	$121	$0
Fitchburg, WI	$64	$36	$81	$117	$0
Ramsey Co., MN	N/A	$28	$81	$115	$0
Visalia, CA	$61	$33	$61	$114	$0
Ann Arbor, MI	$46	$27	$73	$102	$9
Dover, NH	$48	$46	$67	$75	$0
Falls Church, VA	$92	$45	$41	$62	$0
Clifton, NJ	$30	$112	$46	$55	$13
Worcester, MA	$33	$31	$49	$54	$0
Leverett, MA	$20	$58	$7	$51	$17
Chatham, NJ	$51	$102	$38	$39	$8
Bergen Co., NJ	N/A	$103	N/A	N/A	N/A

* including collection, processing, administration, and other costs

Source: Institute for Local Self-Reliance for the Environmental Protection Agency, *Cutting the Waste Stream in Half: Community Record Setters Show How,* EPA-530-R-99-013, June 1999.

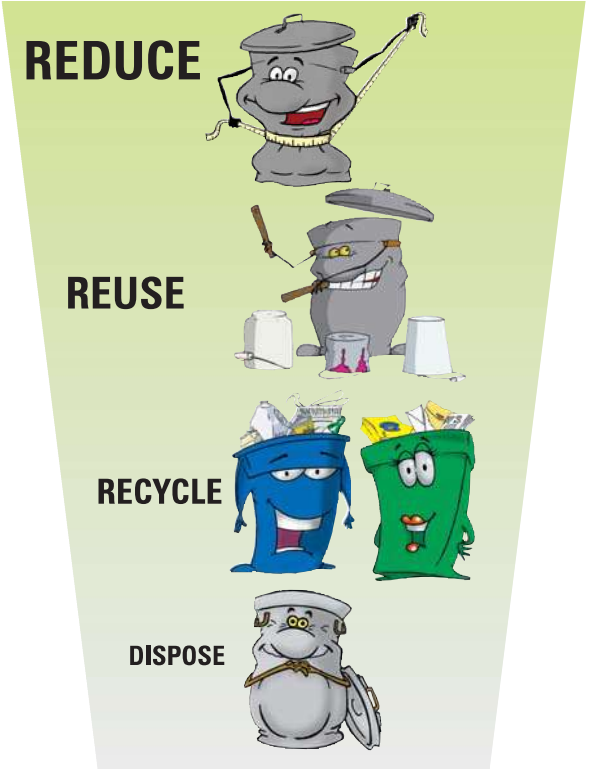
Appendix III
WASTE PREVENTION POLICY AND PLANNING: CLEARING UP CONFUSION

Since New York City's Recycling Program started in 1989, there has been a great deal of interest in waste prevention as a method to address the challenges of managing the waste that New York residents, institutions, and businesses generate each day. "Waste Prevention" refers to practices that eliminate or reduce the amount and/or toxicity of solid waste that is generated in the first place, as opposed to dealing with waste once it has been generated.

Because waste prevention targets many different and multifaceted individual and organizational behaviors, purchasing decisions, and practices that lead to waste creation, it takes many forms, such as:

- Showing industries how to modify production processes or substitute nontoxic chemicals for toxic ones
- Requiring governments to purchase products that are more durable, reusable, and/or repairable
- Urging consumers to buy products with less packaging, to donate unwanted goods to charities, and to reuse materials
- Encouraging homeowners to "Leave It On the Lawn" by not bagging and disposing of grass clippings
- Composting "on-site"—which prevents the waste from ever entering the waste stream

Figure AIII-1
Reduce-Reuse-Recycle Hierarchy



Waste prevention contrasts with other waste-reduction methods like using items that are recyclable or contain recycled material, composting collected organics, and engaging in traditional "recycling." These methods conserve more materials than disposal, but still require collecting, transporting, and processing wastes. For this reason, the widely accepted Reduce-Reuse-Recycle hierarchy sets waste prevention as the first, most efficient, and best step in waste management (Figure AIII-1). In theory,

the premise behind its superiority is clear: for each ton of waste *not* generated, one less ton of collection and transport needs to take place; and—depending on the disposition method—one less ton of material is landfilled, incinerated, recycled, or centrally composted.

The theoretical primacy of waste prevention has led many to ask why New York City is not using it as its premiere method to manage solid waste, and more specifically, why the NYC Department of Sanitation (DSNY) is not formulating solid-waste–management planning with waste prevention as the lead method in its mission. In this Appendix, we answer this question, explaining the following:

- New York City, and DSNY Bureau of Waste Prevention, Reuse and Recycling (BWPRR) specifically, *is already actively engaged in many forms of promoting waste prevention.*
- Over ten years of experience with, and research on, these programs has shown that *potential impacts of waste prevention on the overall waste stream and the DSNY budget are—without state- or federal-level interventions—very small.*
- In some cases, DSNY research has been *mis-cited and misinterpreted* by groups and organizations within the waste-policy community, leading to unfounded expectations of large reductions in the waste stream and massive savings anticipated.
- *DSNY still supports waste prevention at the municipal level because of its great educational benefits* and points to the potential for policymaking at state and federal levels for more fundamental impacts on preventing waste.
- *DSNY does not advocate setting percentage-based waste-prevention goals or mandates, nor conducting long-term planning based on an expectation of a substantial decrease in the DSNY-managed waste stream from waste-prevention programs.*

The Debate Over Waste Prevention

Debate on waste prevention in NYC has centered around two distinct points of view. One position promotes the practice as a *basis for comprehensive, solid-waste–management planning* at the municipal level—advocating that the City commit to, and be held accountable for, preventing the generation of as much as 10 percent of the overall waste stream by imposing a range of programs targeted at residents and public institutions. Those who take this view argue that such goals are not just desirable, they are actually achievable, and that they will mean millions of dollars in annual budgetary savings for the City. Those of this point of view call for more investment in new programs, and a commitment by the City to achieve a measurable reduction in the overall waste-generation rate of residents and institutions.[1]

In contrast, BWPRR contends that the strength of waste-prevention programs lies in their *educational value*. Potential impacts of waste-prevention programs in terms of the reduction of overall waste tonnages have, in reality, proven to be quite limited. Using the same research on its own programs that those of the opposing view reference, BWPRR has pointed out that the evidence does *not* support the assertion that: (1) waste-prevention programs can prevent more than incremental amounts of waste generation; or (2) that benefits balance, let alone outweigh, costs. As a consequence, major budgetary savings should not be expected by implementing waste prevention programs, and solid-waste–management planning should not be based upon

expectations of significant waste reduction through such programs. Making this argument is not, however, to advocate abandoning current waste-prevention programs, nor does it propose ceasing research on the potential of waste-prevention alternatives.

The Problem with the Debate

While debate is healthy in policymaking, it is important that arguments be grounded in empirical evidence. Without evidence, options cannot be accurately compared, and realistic planning cannot take place. Yet, unfortunately, the argument for waste prevention as a basis for solid-waste planning has been, and continues to be, seriously misinformed about the potential impacts of waste-prevention policies and programs.[2] Despite its reference to published research, its claims are often not empirically grounded. Statements that were never based on evidence have gone on to be cited without verification and have gained acceptance as fact, when in truth they are not accurate.[3] This approach to policy debate both delays and confuses the real work that needs to be done to address serious issues facing waste management in New York City today.

For this reason, it is important to clear up the confusion surrounding what can and cannot be expected from waste prevention. To do this, we need to begin by acknowledging the waste-prevention programs that BWPRR has implemented, and the research on the impacts of those programs that has been published. We can then contrast what we have learned with claims in some published work that overestimate the impacts of waste prevention as a basis for solid-waste–management planning. This comparison shows little or no empirical basis to these claims. In fact, many of them contain serious flaws in reasoning. Since such claims, in published form, cite BWPRR's own work, it is important to explicitly refute these assertions. The goal of this exercise is not to discourage interest in waste prevention, but to lay the groundwork to *move on* from a debate that repeats misinformation. There are many serious issues facing waste management in this City today that need clear-sighted attention.

A History of BWPRR's Work on Waste Prevention in New York City

Table AIII-1 (pages 146–147) provides a summary of the various waste-prevention initiatives that BWPRR has conducted over the years. Some of these are described in more detail below.

Early Years

BWPRR's first waste-prevention initiative dates to the early days of the NYC recycling program. In 1990, the Bureau of Waste Prevention, Reuse and Recycling partnered with the Department of Cultural Affairs to support its Materials for the Arts (MFA) exchange program. The program (in existence since 1979) solicits and warehouses items donated by businesses, organizations, and individuals, and makes them available to nonprofit local arts, cultural, and school groups. DSNY supports MFA to this day. In Fiscal Year 2002, it took in about 540 tons of materials that might otherwise have been discarded as trash.

In 1991, BWPRR began to investigate the potential of business waste-prevention programs through the Partnership for Waste Prevention, a group convened to gather and share information, and develop waste-prevention strategies among the City's commercial sector. During the same year, it produced *New York City's Waste Reduction Handbook,* a general guide designed to acquaint New Yorkers with basic waste-prevention

Table AIII-1
A History of BWPRR Waste-Prevention Initiatives

1990 to present	Funding support to **Materials for the Arts**, a citywide materials-exchange program providing NYC arts and educational groups with no-cost furniture and supplies.
1991	Outreach staff distributes ***New York City's Waste Reduction Handbook: Practical Ways to Prevent Waste and Save the Environment*** as an introduction to practical waste-prevention tips for use at home, work, or school.
1991	Pilot **household-hazardous-waste public education and collection events** in Brooklyn.
1991	Launch of **Partnership for Waste Prevention**, a NYC government- and business-sponsored association providing strategies and models for waste prevention in different business sectors, including dry cleaners, supermarkets, Chinese restaurants, and hotels.
1993	Partnership for Waste Prevention conducts reusable tote bag campaign in cooperation with **Food Merchants Association**. Poster campaign in cooperation with the **Dry Cleaners Association** encourages patrons to return hangers, recycle polyethylene bags, and purchase reusable garment bags. **Chinese American Restaurant Association** distributes bilingual signs encouraging patrons to prevent waste by requesting needed condiments with take-out orders. Laminated **Bring Your Own Bag** signs distributed to small merchants.
1993	Partnership for Waste Prevention targets junk-mail reduction through the **How to Stop the Junk Mail Bandit** postcard campaign with the **Direct Marketing Association.**
1993	The ***How to Recycle or Reuse Almost Anything*** guide and the ***Reuse It, Repair It, Rent It, Donate It—But Don't Throw It Away!*** guide were created to educate and encourage New Yorkers to find other outlets for items normally discarded as trash.
1993	Launch of **pilot waste-assessment and assistance program** targeting select businesses and nonprofit organizations. Development and distribution of resulting guide—***Cutting Costs and Preventing Waste in NYC Office Buildings and Institutions: Three Case Studies.***
1993–94	**Household-hazardous-waste public education campaign and collection events** occur citywide. The ***It Makes Business Cents to Prevent Waste*** guide was also developed, which contained waste-prevention case studies and resources for the business sector.
1995	Partnership for Waste Prevention holds a training seminar and produces a waste-reduction guide for local hotels—***Make Waste an Unwelcome Guest: The NYC Guide to Hotel Waste Prevention***.
1996–2000	The **NYCWasteLe$$ Business Project**, a comprehensive waste-assessment and technical-assistance program targeting multiple participants in nine business and institutional sectors, is launched. Training seminars, a series of newsletters, and a video are produced and widely distributed to all businesses within the targeted sectors. Program results, case studies, and a broad array of waste-prevention tips are presented in a printed summary report and on the newly launched **NYCWasteLe$$ Business Project website.**
1996–2001	The **NYCitySen$e Project**, a comprehensive waste-assessment and technical-assistance program targeting different functions within 11 NYC Mayoral Agencies, is launched. ***Finding Dollars in City Trash: The Budget Stretching Guide to Preventing Waste in NYC***

Table AIII-1
A History of BWPRR Waste-Prevention Initiatives *(continued)*

1996–2001 (continued)	***Government Agencies*** is distributed to City employees. Project findings, resulting waste-prevention recommendations, and case studies are presented in eight educational seminars, a summary report, and on the newly launched **NYCitySen$e website.**
1996	**Special Waste Recycling Pilot Drop-off Site** is established in Staten Island. ***Safeguard Your Home From Harmful Products*** brochure is developed and mailed to all households citywide.
1997	**Training Program for Local Development Corporations and Academia** to explore the economic development opportunities of waste prevention and associated technical-assistance programs.
1997	**NYWa$teMatch**, a Department-sponsored materials-exchange and technical-assistance program targeting NYC manufacturers, is launched.
1999	**NYC Stuff Exchange**, a hotline (1-877-NYC-STUFF) promoting the reuse of second-hand goods in New York City, is launched. The hotline provides information on stores and organizations that buy, sell, or accept second-hand goods as donations.
2000	Five permanent **Special Waste Recycling Drop-off Centers** open citywide, based on the success of the Staten Island pilot.
2001	***An Environmentally Preferable Purchasing Guide*** and training course for NYC agency purchasing personnel is developed, and presented at six training sessions.
2001	**Full-page ads** are placed in the City's major daily papers addressing recycling and waste prevention issues. Making use of the "RRR" theme, the waste-prevention ads entitled "RRRemove It" and "RRRethink It" encourage removing names from junk mail lists and provide simple ways to reduce waste at home or work.
2002	**NYCWasteLe$$ individual**, a comprehensive and interactive website promoting the benefits of practicing waste prevention at home, work, and school, is launched.
2002	The NYCitySen$e website is revamped and renamed **NYCWasteLe$$ government** to better match the content structure and style of the NYCWasteLe$$ individual site. Rather than focusing on project results and case studies, the site presents a comprehensive look at waste-prevention and recycling opportunities for all organizations.
2004	A revamped and renamed website for the NYCWasteLe$$ Business Project is launched, with new sections added on Green Building and Extended Producer Responsibility. Now known as the **NYCWasteLe$$ business** site, it is housed with the NYCWasteLe$$ *individual* and *government* sites under one URL, which is then branded as the **NYCWasteLe$$ website.** **BWPRR promotes the NYCWasteLe$$ website** through press releases, Go Cards, email announcements, links on the NYC.gov and Sanitation websites, as well as newsletter articles in energy and water bills. In addition, all recycling decals, flyers, and brochures produced by the Department point people to the NYCWasteLe$$ website for waste-prevention information.

practices. This guide has been available ever since—and can be ordered through DSNY's website or by calling the 311 Citizens Service Center. The introduction of the handbook was paired with a poster campaign mounted in the subways and at businesses, schools, city agencies, and various organizations.

By 1992, these waste-prevention–education materials and others were being regularly distributed, and waste prevention was incorporated into the Department's outreach to residents. In the years that followed, literally millions of brochures, flyers, postcards, posters, and reports were mailed. DSNY staff made appearances at tens of thousands of special events, meetings, and seminars in schools, community organizations, academic venues, and other public fora.

The First Solid Projections of Waste-Prevention Impacts—the 1992 SWMP

Nineteen ninety-two was also the year that the City's first *Comprehensive Solid Waste Management Plan* (SWMP) was published. This multivolume document covered all aspects of wastemanagement planning—including collection, recycling, landfilling, and closure of outdated facilities. One section examined waste prevention in detail, and was the Department's first attempt to estimate the potential impacts of this method on the City's future waste stream.

Using the results of a just-completed waste-composition study, which broke down the waste stream into material categories such as paper, plastics, glass, organics, metals, etc., the Plan provided an initial estimate of the long-term, waste-reduction impacts of eight waste-prevention programs, none of which had been implemented at the time—but all of which had been recommended by waste-prevention advocacy groups involved in drafting this portion of the SWMP.

The Department's consultant, CalRecovery, Inc., forecast the potential, waste-reduction impacts of these programs using data available in 1992 about economic conditions in New York City and the nation at the time, as well as a number of assumptions about the future. These impacts were forecast in the context of an envisioned (but never realized) scenario in which:

- Widespread packaging and other legislation aimed at producers would be in place throughout the U.S.
- A host of material-specific, waste-reduction programs, implemented at the state and federal levels, would be active in NYC.

At the time, CalRecovery took great pains to stress the tenuousness of their forecasts, writing that "it is important to recognize the[ir]

The 1992 Solid Waste Management Plan's Proposed Waste-Prevention Programs

1. Legislate waste-audit requirements
2. Fund a nonprofit waste exchange for shipping waste and nonhazardous material
3. Support efforts to promote voluntary reduction in packaging
4. Modify City procurement guidelines to stipulate the purchase of reusable products and to minimize packaging
5. Develop programs for "junk mail"
6. Increase support for reuse centers
7. Develop "Leave It On the Lawn" and backyard composting programs
8. Monitor the progress of "Leave the Packaging Behind" initiatives

Source: New York City Department of Sanitation, *Comprehensive Solid Waste Management Plan,* pp. 7-8 to 7-10.

speculative character."[4] Continuing, CalRecovery noted that "three key factors make the assumptions...at best educated guesses."[5] These included:

- "A near complete absence of data—many of the strategies [upon which the estimates were based] have never been implemented anywhere..."[6]

- The fact that "waste prevention activities are likely to have interdependent and cross-cutting impacts. Efforts to reduce one type of waste may increase the generation of another. [But] a model that could account for these interdependencies would be enormously expensive to develop and unwarranted given the dearth of data..."[7]

- The need to rely on, "composition data by material—[such data] simply do not provide the level of detail needed to make estimates of waste prevention impacts."[8]

As a result, CalRecovery concluded, "the assumptions that follow may err by considerable margins. *These assumptions should not be taken as estimates of likely programmatic impacts* [emphasis added], but as rough guesses intended to appraise the scale of impact of an aggressive waste prevention program, to uncover inconsistencies and to identify important subjects for future research."[9]

With these caveats, the Plan presented *potential* material-specific impacts that totaled a reduced tonnage of 670,000 tons per year, or 8 percent of the total DSNY and commercial waste stream—then a little over 8 millions tons. Out of this, 250,000 tons would come from the roughly 3 million tons of residential waste prevented (representing 9 percent of the total residential stream). CalRecovery then extrapolated the potential cost savings from such reduced tonnage, using the costs to process waste that prevailed at the time. In this hypothetical scenario, savings were estimated to be in the range of $87 to $90 million in FY 2000; or when totaled in real dollars, $700 to $800 million between 1992 and 2010.

Program Development Continues

After the publication of the SWMP, BWPRR turned its focus to developing and implementing waste-prevention programs in the real world. In mid-1993, its partnership efforts led to four major business-focused campaigns. First, BWPRR worked with the Neighborhood Dry Cleaners Association (NDCA), which represents more than half of the City's 2,200 businesses, to promote awareness of waste prevention and its potential cost savings. Mail surveys gathered information about business practices, which was used to develop store posters encouraging customers to return hangers and to opt for reusable garment bags. The NDCA distributed posters to cleaners throughout the City, and BWPRR staff conducted 70 in-person outreach visits as follow-up. A second, similar partnership with the Food Merchant's Association led to the distribution of brochures and store posters to hundreds of outlets encouraging customers to bring reusable bags and refuse unnecessary plastic bags. Work with the Chinese American Restaurant Association led to production and dissemination of posters encouraging customers not to take more single-use utensils or sauce packets than needed. A fourth project was conducted in 1995 with the Hotel Association of New York City to address waste prevention in this sector. It included a series of seminars and the subsequent production of a booklet entitled, *Make Waste an Unwelcome Guest: The NYC Guide to Hotel Waste Prevention.*

The year 1993 also saw a new campaign designed to help residents prevent waste by removing their names from household direct mail lists. BWPRR worked with the Direct Marketing Association to develop a

postcard telling residents how to register for the Association's "Mail Preference Service," and then sent bilingual English-Spanish postcards to all 2.9 million NYC households that year. These efforts were reinforced by continuing to distribute the cards through public offices, libraries, and other organizations, as well as making this information available through the Sanitation Action Center (DSNY's customer-service hotline) and on the DSNY website. In that same year, BWPRR began including waste-prevention information in the consumer Yellow Pages directories distributed by the local telephone company (then NYNEX, now Verizon). A second informational brochure, *Reuse It, Repair It, Rent It, Donate It—But Don't Throw It Away!,* was developed with information about the repair, rental, purchase, and donation of used goods. Also launched in 1993 was the Botanical Gardens Compost Projects, a program to promote backyard and small-scale composting to New York City residents, institutions, and businesses through outreach, education, and technical assistance.

In 1993, with funding from the New York State Office of Recycling Market Development and initial input from INFORM, a nonprofit environmental group, BWPRR began working with the Council on the Environment of New York City (CENCY) to conduct a series of waste-prevention assessments and assistance projects with businesses and nonprofit organizations in New York City. HBO, Kinney Shoe, and Columbia University participated during the first year of the Program. The results of waste audits and subsequent operational changes to prevent waste in these organizations was presented in a guide called *Cutting Costs and Preventing Waste in NYC Office Buildings and Institutions: Three Case Studies.* Results were impressive. Each organization reduced its waste stream by approximately 11 percent, and cut costs considerably.

In 1994, BWPRR bolstered its business waste-prevention efforts by adding two pages of waste prevention tips in the business to business Yellow pages, and publishing a new guide on the topic. *It Makes Business Cents to Prevent Waste* included real examples of cost-saving initiatives that companies had adopted, and listed organizations that would accept donation of corporate goods. The guide was included in the commercial-recycling-law information packet distributed to all NYC businesses that year.

In 1996, the Department targeted other City agencies with a new guide: *Finding Dollars in City Trash: The Budget Stretching Guide to Preventing Waste in NYC Government Agencies.* This was accompanied by a poster campaign among agencies, which included posters encouraging city employees to save paper by making double-sided copies. The next year, the Department used an EPA grant to link Local Development Corporations (LDCs) and academic institutions and explore their role in waste-prevention training and technical assistance. Seven LDCs (from Brooklyn and the Bronx), seven academic institutions, and several businesses—a total of 40 organizations—were brought together for two days of discussion, observation of manufacturing facilities, and training. The seminar resulted in the development of a training pack for future use by these and other LDC's, as well as working collaborations.

To promote the benefits of waste prevention and recycling to New York City businesses and institutions, BWPRR, with its consultant, Science Applications International Corporation (SAIC), developed the NYC WasteLe$$ Business Project—a waste-assessment and technical-assistance program, conducted from October 1996 through 2000, that targeted nine business and institutional sectors, including airports and airlines; hospitals; manufacturing facilities; restaurants; retail establishments; retail food establishments; schools; stadiums, arenas, and convention centers; and wholesale industries. The Project focused on helping participating companies reduce the volume and toxicity of their solid waste, increase energy and water efficiency, and reduce waste-related costs.

Waste-prevention teams worked with individual businesses and institutional partners within each sector to identify specific, cost-saving, waste-reduction opportunities and to establish implementation plans. After implementation, Project staff presented project case studies and key, industry-specific waste-prevention issues at numerous educational seminars. In addition, the Project developed and disseminated periodic, industry-targeted newsletters to the larger NYC business and institutional community. A video, *NYCWasteLe$$: Cutting Costs by Cutting Waste,* was also created and distributed. The work of the NYC WasteLe$$ Business Project is described in detail in the comprehensive NYC WasteLe$$ Summary Report, and formed the basis for the development of the NYCWasteLe$$ website (described below), originally launched in 2001. Relevant, sector-specific, waste-prevention tips can be found in the virtual business tour section of the site.

In addition to the NYC WasteLe$$ Business Project, BWPRR worked with SAIC to launch NYCitySen$e—a research and technical-assistance program for City agencies to increase waste prevention and enhance recycling, in operation from 1996 to 2001. As part of the program, 11 agencies, representing a cross-section of City services, received waste audits. The program also involved gathering information on purchasing and operating procedures through questionnaires, staff interviews, and on-site observations. Program staff used this data to identify cost-effective waste-prevention opportunities for each agency, which were then reviewed with agency personnel. NYCitySen$e offered follow-up technical assistance to help document the quantities of waste reduced, as well as the cost savings resulting from the implementation of these strategies in the selected agencies. BWPRR and SAIC disseminated results of the NYCitySen$e program through various means, including eight educational and training seminars, a *NYCitySen$e Project Summary Report,* and a newly established CitySen$e website. The NYCitySen$e website has since been revamped and renamed "NYCWasteLe$$ government" and is housed within the NYCWasteLe$$ website described below.

In 1997, the Department contracted with the Industrial Assistance Corporation and the Long Island Business Corporation to develop Wa$teMatch, a service that helps businesses save money by providing a brokerage service for industrial scrap materials, pallets, packaging, and other reusable items that do not have well-established recycling markets. Today, Wa$teMatch is still going, sponsored by DSNY in a cooperative effort with the City University of New York, the Industrial Technology Assistance Corporation, and the Empire State Development Corporation.

In 1999, BWPRR launched a pilot version of an automated telephone system with information about how to donate, buy, sell, rent, or repair reusable goods. Today, that hotline, the NYC Stuff Exchange, is active citywide, and lists over 10,000 organizations and businesses. An easy-to-follow menu allows callers to choose from several options (such as donate, sell, buy, repair, or rent) and then select from a list of item categories (such as clothing, furniture, books, electronics, appliances, etc.) to get information for the entered zip code. If a particular listing cannot be found for that zip code, the system provides information for the neighboring zip code areas. Users have the option of listening to the information or requesting a fax of the listings.

In 2000 and 2001, as a direct result of the NYCitySen$e project and other Department-sponsored procurement-policy research, BWPRR and SAIC developed an Environmentally Preferable Purchasing (EPP) Guide, Teacher's Manual, and class for City agency purchasing personnel. In coordination with Department of Citywide Administrative Services, the Procurement Training Institute (PTI), and the Mayor's Office of Operations, six trial EPP classes were held in Spring 2001 with City agency procurement personnel. Based upon class evaluations, PTI incorporated the class into its list of regular course offerings that same year.

In 2004, BWPRR debuted a website entirely devoted to waste-prevention outreach and education for individuals, public agencies, and businesses, at www.nycwasteless.org. The interactive site contains a huge amount of information on waste-prevention methods—including a number of self-assessment tools; access to publications and links; and detailed descriptions of ways to reduce, reuse, and lessen the toxicity of materials used in the home, the workplace, and everywhere in-between.

To help get the word out about the NYCWasteLe$$ website, BWPRR conducted the following promotional activities:

- Emailed announcements about the site to solid-waste and government organizations, publications, and listserves
- Posted a link to NYCWasteLe$$ on the City of New York website: NYC.gov
- Added information about NYCWasteLe$$ to many printed materials
- Placed announcements about NYCWasteLe$$ in the consumer newsletters that accompany Keyspan Energy bills, Con Edison bills, and NYC Department of Environmental Protection water bills
- Placed over 400,000 postcards in local bookstores, bars, and restaurants with Go-Card; and conducted an outdoor poster campaign with Go-Poster
- Distributed NYCWasteLe$$ postcards at NYC Department of Parks MulchFest event and Earth Day events
- Sent letters about NYCWasteLe$$ with postcards for distribution to local business development corporations, business improvement groups, environmental organizations, community-based civic organizations, libraries, public schools, and religious institutions
- Contacted civic and environmental websites about placing links to NYCWasteLe$$ on their sites

Comprehensive Waste-Prevention Evaluation

In the Spring of 2000, BWPRR issued a series of reports evaluating the impacts—in terms of tons of waste prevented and costs—of programs implemented since 1992. These reports represented the first attempt to measure the impact of actually implemented waste-prevention programs in NYC, and followed on the 1992 SWMP's projections. The reports were written by an independent consultant, Science Applications International Corporation (SAIC), which undertook a comprehensive review of DSNY funds expended on waste prevention programs and tons prevented. It also took into account a host of other variables, including non-DSNY waste prevention initiatives going on in this period, changes in the overall materials economy, indirect costs and benefits of DSNY programs and, in the case of business-focused programs, direct costs and benefits to participants within the private sector.

The evaluation was a complex undertaking, and results do not lend themselves to a "bottom-line" summarization. For the details, readers are strongly urged to consult the reports themselves, which are available at the Department's website.[10] Overall, the reports estimated that DSNY programs had reached an annual impact of preventing 72,529 tons of waste in 1998, the year for which the most complete data was available[11] (Table AIII-2).

Table AIII-2
Reproduction of Table Summarizing Annual Impact of Waste Prevention Due to City Programs and Related Activities

Source of Waste Prevention	Waste Prevented (Tons)	
City Programs	***1998***	***2002***
NY Wa$teMatch	293	1,448
NYC Stuff Exchange	N/A*	4,994
NYC WasteLe$$	68,830	68,830
Unwanted Direct Mail	186	0
Materials for the Arts	434	578
Outreach to Chinese Restaurants	120	120
Outreach to Dry Cleaners	305	311
Grocery Store Outreach	1,027	1,048
CENYC Waste Assessments	1,334	1,334
DCAS	N/A	N/A
NYCitySen$e	N/A	N/A
TOTAL	72,529	78,663

* N/A means that the data are not yet available.

Source: First published in SAIC/Tellus Institute, *Measuring Waste Prevention in New York City,* Spring 2000, Table 3-1, page 116.

The major contributor to this tonnage prevented was the NYC WasteLe$$ Business Project, which was estimated to prevent 68,830 tons of waste that year. The research projected a growth in waste-prevention programs to close to 79,000 tons by 2002. What about costs? For direct costs to DSNY alone, waste prevention ranged from $24 per ton for the NYC WasteLe$$ Business Project to over $300 per ton for Materials for the Arts.[12]

SAIC arrived at these estimates using a number of methods, including:

- "Direct Measurement," which included direct program monitoring through case studies, audits, and reporting requirements; surveys and field work; and waste-characterization studies
- "Source Reduction Cost Analysis," in which the cost of undertaking the source-reduction effort and the savings in purchasing and disposal costs were calculated to yield the realized total costs of the effort
- "Source Reduction Program Potential Estimates," which applied existing data regarding the amount of waste generated, detailed information on the waste stream and potential participants, and technological data to calculate program potential expressed in tons of waste per year

The Misuse of DSNY Data in Waste-Prevention Advocacy

The 1992 SWMP and the 2000 SAIC Reports are the only two comprehensive evaluations of the predicted or actual waste-prevention impacts and costs of various DSNY programs. Both consultants responsible for these evaluations stressed the limits to, and proper use of, the estimates and projections they contain. In particular, these consultants argued the impossibility, in some cases, of linking actual effects to waste-prevention actions; the difficulty and cost of getting reliable measures for programs where participants or potential participants are many and dispersed; waste-prevention–evaluation methodology's heavy reliance on self-reporting; and, finally, the complexity of *indirect* costs and benefits.[13]

BWPRR's concern over the limits of waste-prevention evaluation has been interpreted by some in the waste-prevention community as simply a reflection of DSNY's negative bias against waste prevention in general.[14] In this view, the fact that some waste-prevention programs have prevented small tonnages of waste at costs that compare favorably to those for recycling or waste export is evidence enough that, in the words of the Waste Prevention Coalition, "waste prevention will, for a relatively small investment, avoid larger expenditures on collection and export."[15]

What is wrong with making such predictions? They are not grounded in fact. There are two sources of error that drive such mistakes, which have made their way into public discussion over solid-waste–management planning in New York City. The first is inappropriate citation of outdated information from the 1992 SWMP. The second is inappropriate citation of more recent data from the 2000 Waste Prevention Reports.

Misuse of 1992 SWMP Data

Despite the caveats published with both of the 1992 SWMP Projections, and the fact that they are now 12 years out of date and have been superceded by more current research, the estimates of preventable waste in NYC are still regularly cited as fact. For instance, an article published in the year 2000 by the Institute for Local Self-Reliance states that:

> In 1992 the City adopted but never implemented a waste prevention plan that was projected to achieve a 9% reduction in solid waste by 2000. Such a reduction would save the City hundreds of millions of dollars in avoided collection costs.[16]

The New York City Waste Prevention Coalition's "Bare Facts," also published in 2000, states in almost identical language that:

> In 1992 the City committed to reduce its solid waste by 10% by 2000. At a savings of $65/ton over export, a reduction of 1,110 a day would amount to a savings of $71,500/day or well over $20 million per year.[17]

And testimony before the City Council in June 2000 by the Waste Prevention Committee of the Manhattan Citizens' Advisory Board calls the "Potential for Waste Prevention in NYC, Year 2000" an "Opportunity Missed," reminding the Council that:

> The Department of Sanitation calculated that $90 million could be saved annually by implementing 9% waste prevention by 2000.[18]

Because of (1) the contingent nature of the estimates published in the SWMP, as discussed earlier; and (2) the fact that these estimates are 12 years out of date, it is simply not appropriate to cite "Department of Sanitation calculations" of multi-million dollar cost savings as "opportunities missed."

Misuse of 2000 Waste-Prevention Reports' Data

Each waste-prevention program profiled in the Department of Sanitation's series of waste-prevention reports—prepared by Science Applications International Corporation (SAIC) and published in 2000—targeted a different aspect of the waste stream, contained different cost-benefit assumptions, and was carried out over different time periods. For this reason, nowhere in these reports was an "overall" cost per ton of waste prevented stated. Nonetheless, this figure has been cited, and has been attributed to DSNY's own research, in several published articles and testimony. Although it is not clear where the mis-cited figure of "$27 per ton" comes from, it is possible that it was derived from two numbers that were published in these reports. The first is the overall tonnage prevented by DSNY-funded waste-prevention programs. This was projected as 78,663 tons in 2002.[19] The second is the total expenditures in 2002 on DSNY waste-prevention programs. This total was $2,135,111.[20] Dividing total expenditures by estimated tons of waste prevented in 2002 yields a figure of $29 per ton, which is close to the $27-per-ton estimate.

What is wrong with using such calculations to estimate the cost of "waste prevention" in general, rather than for a particular program in a particular year? After all, isn't it reasonable to assume that if the waste-prevention–program expenditures in 2002 prevented an estimated 79,000 tons of waste annually for about $2.3 million, then double the outlay—$4.6 million—would prevent double the waste, or 158,000 tons? Unfortunately not. Unlike costs for refuse disposal and recycling—which depend on relatively straightforward, fixed processes—each waste-prevention program is different, contains different costs and benefits, and has impacts that, measurement problems aside, will vary widely from year to year.

Furthermore, the mere fact that an activity is cost-effective says nothing about the amounts of waste that can be reduced by funding it. For instance, the City's "Unwanted Direct Mail Reduction Campaign" prevented an estimated 1,000 or more tons of waste over five years, and cost roughly $88,000. This translates to a cost of $88 per ton, which is competitive with collection and disposal. If double the amount were spent on this program, double the waste might or might not be prevented (this would depend on a complex set of factors having to do with who was or was not reached by the campaign in the first go-around, and how much waste is, under any circumstances, preventable by such a campaign). What is definitely false is that if 100 times the funds were spent on this program, that 100,000 tons would be prevented.

Although this point may seem painfully obvious, it has nevertheless been lost on many in the waste-prevention–advocacy community. When one number is mis-cited, it leads to other

Inaccurate Citations

"Waste prevention is cost effective—DOS's programs have heretofore cost only $27 a ton."[21]

"In 2000 the DOS's long-delayed, 10-volume waste prevention research by the SAIC consultants showed that the few, mainly business waste prevention programs it had implemented, had cost $27 a ton."[22]

"Waste prevention programs cost $27/ton according to SAIC Report (2000)"[23]

"DOS's figures show that its waste prevention programs have cost about $27 per ton."[24]

"Waste prevention costs only $27 per ton, while exporting it costs up to $100 per ton"[25]

Sources cited in Endnotes section, pages 206–207.

miscalculations. These miscalculations, repeated in published sources, take on the appearance of facts. A mythology develops in which it is taken as self-evident that, for instance:

- "As tons of waste are prevented, collection trucks, personnel, and eventually even garages, as well as processing and disposal facilities, can be stretched farther."[26]
- "Processing, treatment, and disposal costs associated with the construction and operation of solid waste management facilities can also be reduced."[27]
- Single or short-term waste-prevention investments "extend into the future, more than making up for the initial investment."[28]
- "Waste prevention has proven itself to be by far the most cost-effective way of dealing with solid waste."[29]

Clearly, having an impact on trucks, personnel, garages, facilities, processing, treatment, and, in general, "dealing with solid waste" is dependent upon waste prevention gaining a critical mass so as to be more than a minuscule fraction of diversion, as it currently is now (79,000 tons are 0.002 percent of the DSNY-managed waste stream). While there is no harm in advocating an "every little bit helps" approach to waste-prevention programs, it is not wise to expect that simply increasing funding to such programs will push the City anywhere near this critical mass. And it is, moreover, misleading to argue that the City is needlessly forgoing millions of dollars in savings by not (somehow) attaining this critical mass.

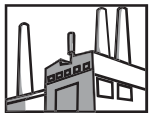
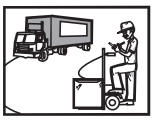
Where Waste-Prevention Programs Can Make A Difference

Waste-prevention policies focus on both producers and consumers (Figure AIII-2). Producer-focused initiatives intervene in the process of manufacturing and distribution. Consumer-focused approaches encourage individuals, agencies, or firms to alter consumption habits.

For reasons of economic and legislative scale, producer-focused policies must be enacted at national or state levels. Experience with Bottle Bills, among the few producer-focused, waste-prevention policies to have significant success in the United States, suggests that intervening at the point of production and distribution is a powerful tool for increasing diversion and achieving product and process modification. Current work on "Extended Producer Responsibility" through the EPA and agencies and organizations seeks to involve the businesses who create what will eventually end up as garbage in partnerships that will save money all around.

DSNY is very interested in pursuing Extended Producer Responsibility as a means of preventing waste, but implementation of producer-focused policies are currently outside of the sphere of DSNY's jurisdiction. As a result, all of the waste-prevention initiatives that DSNY has implemented have focused on consumers. The consumer focus is also seen in the 2002 Community-Based "Waste Prevention Coordinator" project, funded by the City Council and overseen by DSNY, and staffed by an independent group of waste-prevention facilitators working on a variety of community projects to reduce waste.[30] It is easy to see why efforts at this scale—efforts to persuade individuals or institutions to change purchasing decisions and alter consumption practice—are incremental, hard to sustain, and, in the face of overall waste-generation trends, tiny.

Figure AIII-2
Types of Waste-Prevention Policies

	Policy Focus	Mandatory (laws)	Voluntary (programs)	
PRODUCERS	 Manufacturers	recycled-content laws taxes on wasteful products or processes material bans	process change change in materials	design change waste exchanges
	 Marketers/Distributors	Bottle Bills other deposit laws	packaging reduction take-back programs	
CONSUMERS	 Businesses		waste exchanges double-sided copying disposable item reduction	buying less buying in bulk pre-arranged take-back agreements
	 Public Institutions	environmentally preferable purchasing laws	double-sided copying disposable item reduction buying less	buying in bulk pre-arranged take-back agreements
	 Residents		junk-mail–reduction programs clothing/furniture donation buying less buying in bulk	backyard composting "Leave It On the Lawn" or grass recycling

Area where a municipality has jurisdiction

Waste-generation trends are linked not primarily to individual or institutional behavior, but to the growth of the national and global economy. Over the decades, general output of consumer products has risen, periodic recessions and source-reduction goals notwithstanding. For example, Americans used 10 percent more paper per capita in 1997 than a decade earlier, and 34 percent more than two decades earlier.[31] Overall growth in commodity output is seen worldwide, even in countries like Germany and the Netherlands, where a stronger tradition of government regulation has enabled the imposition of producer taxes for waste reduction (such as Germany's Green Dot program).

At the same time, the total tonnage of waste in New York City has, since the 1970s, gradually decreased, largely for reasons having to do with the lightweighting of consumer products and other changes in the way goods are manufactured.[32] This reduction, which has taken place in periods with and without waste-prevention programs—or even recycling programs—reflects the fact that broad-scale changes in the U.S. economy drive waste generation. In this regard, it is all the more crucial to be informed about the scale at which policy intervention will, and will not, make a difference.

In sum, waste-prevention programs are not a practicable method to address the enormous challenges New York City faces in waste management today. Recognizing this does not negate their educational value. It does argue against spending time, effort, and resources on planning as if waste-prevention programs could actually save money or reduce tonnages in any significant way.

Appendix IV
PUBLIC EDUCATION ABOUT RECYCLING

Since New York City's Recycling Law was passed in 1989, discussion about recycling policy in New York City has focused a great deal on public education. The City's most recent fiscal crisis (2002 and on) has intensified this discussion, as cuts to the public education budget were made along with temporary suspension of certain materials from recycling collection. But even during periods of full funding and an active, multifaceted public education campaign, some have argued that deficiencies in education and outreach have prevented New York City's diversion rate from reaching its true potential, thereby interfering with the fiscal and environmental success of recycling in NYC.

For example, in 2001, when diversion stood at around 19 percent, the Natural Resources Defense Council asserted that:

> If New York City were to strengthen its recycling public education efforts, and more New Yorkers were to become familiar with precisely what should be recycled, recycling rates would be expected to increase.[1]

A year later, the Citywide Recycling Advisory Board echoed this position, stating that "the City's 20% recycling rate is partly due to the fact that more than half the recyclables are thrown in the trash—the result of inadequate education."[2]

Such observations are characteristic of a view that has dominated debate about recycling in New York City over the years. This view holds that there were problems with recycling public education in the past, and that spending more in this area could and would increase the diversion rate beyond the 20 percent attained in 2001. Implied in this perspective is the notion that there are untapped areas of public education program development that, if addressed, would further boost diversion. In other words, not just more but "better" recycling public education is needed.

Now that the recycling program is fully restored, and fiscal constraints facing all City agencies are beginning to ease, it is crucial to have an objective idea of what can realistically be expected from major changes to public education spending and/or approach. In other words, are there different ways to educate residents that the City should undertake now that the full recycling program has been reinstated? Should the City spend more on recycling public education than it did annually between 1997 and 2002? And has purported "inadequate education" (as cited above) really contributed to problems with recycling in the past?

Fortunately, these are questions that can be empirically investigated. New York City's spending levels on public education, and its choice of campaign elements, can be compared to those for other U.S. jurisdictions to identify any missing approaches that have been successful elsewhere. In addition, a large body of survey data exists to document citizen knowledge about recycling in New York City throughout the 1990s, which speaks to the effectiveness of the City's public education campaign.

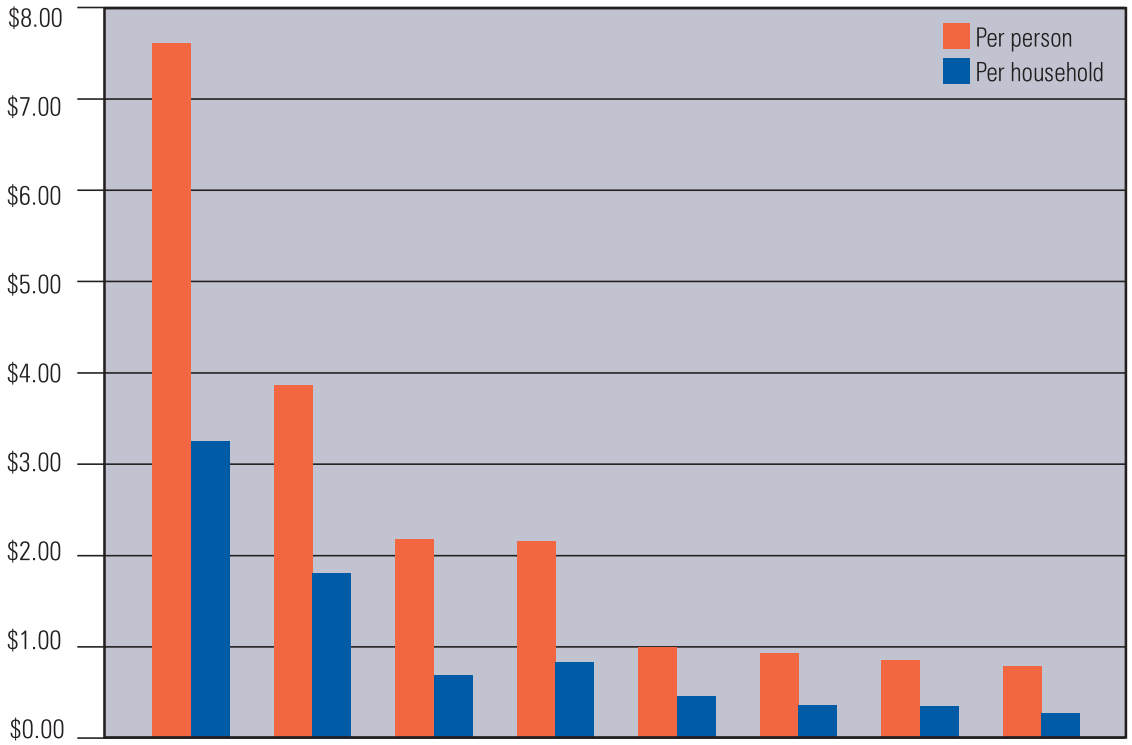
Spending

Since planning for the "Expanded Recycling Program"[3] began in 1994–1995, the Department has averaged roughly $6 million per year in public education spending, which translates to a little over $2.00 per household per year. Conversations with recycling coordinators in several other large, major cities show that this spending level is slightly above average (Chart AIV-1).

San Francisco has a substantially higher expenditure level than other cities because outreach and education are independently funded through a fee assessed for private collection, rather than through a general fund—thus freeing this budget item from competing with other city funding priorities.[4]

In one of the most complete studies on recycling public education spending to date, Skumatz and Green found that spending among 140 Iowa municipalities averaged $1.00 per household per year.[5] This study found that "communities with low diversion tended to have lower outreach expenditures than those with high diversion."[6] The study also found that "adding $1 in expenditures [per household per year] adds 3% to recycling rates," in communities with lower than average expenditures, and roughly 1% in communities with higher than average expenditures (i.e., those already spending more than $1.40 per household per year).[7] Using this estimate, it would cost New York City an additional $3.2 million annually to raise the diversion rate by one point.

Chart AIV-1
Annual Public Education Expenditures



	San Francisco	Seattle	San Jose	New York	Portland	Chicago	Boston	Los Angeles
Per person	$7.58	$3.87	$2.17	$2.15	$1.00	$0.94	$0.83	$0.78
Per household	$3.22	$1.78	$0.67	$0.81	$0.42	$0.35	$0.34	$0.27

Source: 2003 DSNY telephone survey.

It would thus appear that New York City's spending level *per se* has not been inadequate, when compared to other major U.S. cities and major studies of funding trends. However, the level of funding alone does not determine program success. The choice of elements in a public education campaign is also crucial. How does NYC stack up against other places in this area?

Campaign Elements

Cutting the Waste Stream in Half (profiled in Appendix II), by the Institute for Local Self-Reliance (ILSR), asserts that certain elements of public education campaigns are key to achieving record-setting diversion rates:

> All our community record-setters promote recycling through education, publicity, and outreach.…More and more communities are taking advantage of the Internet to spread the word about recycling.…Effective educational tools include fact sheets, newsletters, recycling guides, posters, utility or tax bill inserts, calendars, radio and newspaper ads, hotline, web sites, PSA's, appearances on local cable shows and booths at community events.…Producing educational materials in more than one language can help increase understanding and participation.[8]

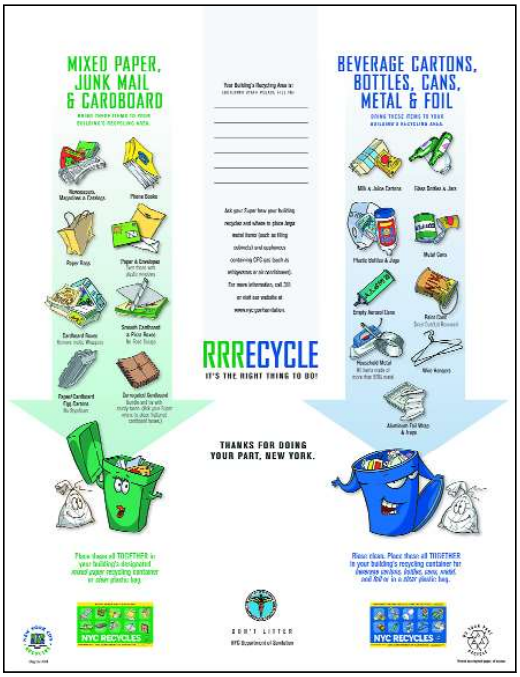
> Some communities promote recycling and education through in-person education...[in Visalia, CA] staff were always willing to meet with individuals to resolve any issues. This personal contact with residents was an important element in creating Visalia's successful program.[9]

At first glance, the ILSR's list of "keys to success" seems compelling. After all, who could argue that education in these forms *isn't* helpful? There is no doubt that successful programs depend on public education and outreach to communicate recycling guidelines and rules. At the same time, simply observing that certain elements of public education are present among programs with high diversion rates does not address the question of whether there is a relationship between diversion and these elements.

In fact, most recycling programs—"record-setting" or not—tend to use the same strategies. For instance, in New York City, the DSNY Bureau of Waste Prevention, Reuse and Recycling (BWPRR) promotes recycling and waste prevention through publicity, education, outreach, and the internet. It uses fact sheets, recycling guides, posters (Graphic AIV-1), radio and newspaper ads, a hotline, public service announcements, utility/tax-bill inserts, as

Graphic AIV-1

Image of NYC's recycling poster for apartment buildings. The poster has space for building superintendents to write in specific instructions for their tenants. The other side of the poster is printed in Spanish.



well as recycling pages in each borough's yellow pages. For many years, BWPRR has placed promotional materials, such as posters and placards, on subways, buses, phone kiosks, storefronts, and on the sides of buildings (Photo AIV-1).

BWPRR routinely produces materials in three languages—English, Spanish, and Chinese, which are distributed through the DSNY website, the 311 Citizen's Service Center, or by staff at community events (Graphic AIV-2). Of the elements that ILSR lists, only newsletters and calendars have not been part of the City's public education program.

Many of the public education elements in use by NYC are seen in the public education programs mounted by other major cities, such as Chicago, San Francisco, Seattle, and Los Angeles. Those cities in which waste management is privatized use the billing process as a communication vehicle. Seattle is distinguished by its semi-annual newsletter mailed with residents' collection service bills. San Francisco also incorporates education into billing, which is part of its privately run collection service. But overall, the range of strategies and initiatives undertaken by these and all other major cities is remarkably similar.

A less common program involves "building captains"—volunteers who organize recycling arrangements and provide some outreach to fellow tenants. Seattle and San Francisco both offer rebates on collection bills if a resident volunteers for this duty; Boston runs a voluntary program along these lines as well. Another novel approach is San Francisco's intensive, neighborhood campaigns, which are conducted every six months in each of six zones in the city to reinforce recycling participation. The campaigns are based around a phone banking operation that contacts a minimum of 15,000 households in the targeted neighborhood, and supplements this contact with door-to-door distribution of information, as well as local transit ads, street signs, newspaper ads, presentations, and press releases/articles in community papers.[10]

Photo AIV-1

Pictures from some of BWPRR's outdoor advertising campaigns: Manhattan *NYC Recycles* billboard in 1992, recycling checklist phone kiosk ad in 1999, and the *New Yorkers Recycle More, Waste Less* "Go Poster" in 2004.

So which forms of public education work, and which don't? The research of Skumatz and Green, which focused exclusively on Iowa communities between 700 and 200,000 households, found that newspaper advertisements and articles, bill stuffers, and brochures led to increased diversion in urban and suburban areas, while TV

advertisements, point-of-purchase approaches, and door-to-door strategies did not.[11] This study hypothesized that diversion-rate outcomes would "vary based on the quality and type of outreach." It concluded, however, that "data were insufficient to analyze these and other questions."[12]

Another commonly cited element to a successful recycling program is work with schoolchildren. The ILSR Report observes, "education programs directed at school-age children produce positive environmental attitudes, which are retained over time."[13] This is by no means a novel idea. The notion that "reaching the children early" is key to recycling and overall environmental progress has, for decades, enjoyed great resonance among a diverse constituency. And in most cities, including New York, recycling program staff focus on schools.

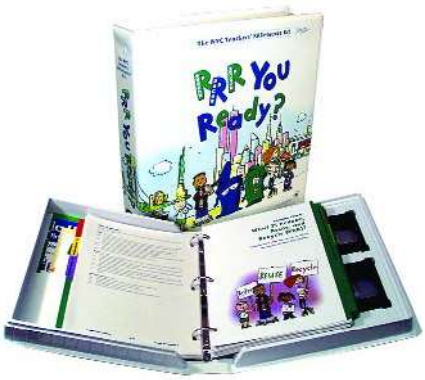
Since the recycling program began, BWPRR has developed educational materials geared specifically for NYC's approximately 1,200 schools. These materials include how-to-recycle information; curriculum materials for teachers; and for students, coloring and comic books, as well as fun give-aways such as t-shirts, backpacks, and beanie toys (Graphic AIV-3). There is also the annual Golden Apple

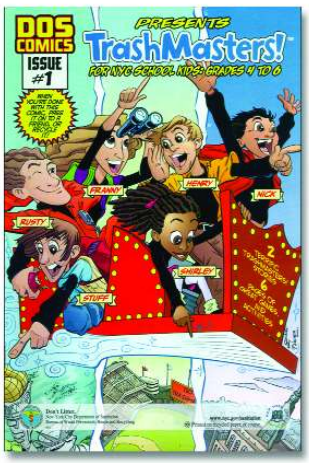
Graphic AIV-2

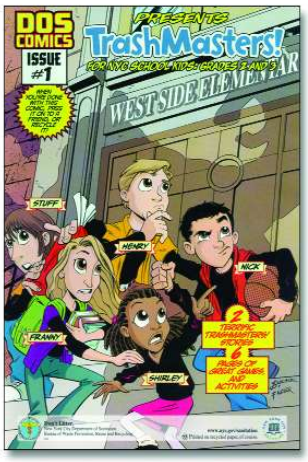
BWPRR regularly produces recycling flyers in English, Spanish, and Chinese, such as the recycling checklist flyers shown here.

Graphic AIV-3

Left: To help NYC teachers incorporate recycling and waste prevention information into the school curriculum, BWPRR developed the *NYC Teachers' RRResource Kit: RRR You Ready?*—an over 300-page multimedia resource package that contains lesson plans, videos, and various reference materials. Developed in collaboration with the NYC Department of Education, the RRR Kit meets the teaching and achievement standards recently instituted into the NYC school system. Right: Building upon the themes presented in the RRR Kit, BWPRR developed two comic books that contain stories about the *TrashMasters!*—NYC kids who learn, and then teach their peers about reducing, reusing, and recycling.







Awards program where DSNY gives cash prizes to schools for their waste-prevention, recycling, and neighborhood clean-up efforts (Graphic AIV-4).

In recognition of BWPRR's school recycling materials, the Solid Waste Association of North America (SWANA) awarded BWPRR the 2002 Gold Award for Excellence in School Curriculum. During the same year, BWPRR also received the Silver Award for Excellence in Public Education (Photo AIV-2).

Even though NYC's recycling education program uses similar techniques to those employed in other places, and its spending levels have historically been on par with other cities, what has sustained the notion that in NYC, public education for recycling underperforms? A third consideration could be that the *quality* of public education in New York City differs from other places. In other words, New York City may be spending the same as other cities, and doing the same things, but its efforts are not getting through to residents. As the next section will explain, extensive market research conducted on DSNY's behalf suggests that this is not the case.

Graphic AIV-4

Each year, BWPRR encourages schools to engage in waste prevention, recycling, and neighborhood beautification efforts through the three contests that make up the Golden Apple Awards program. Within each contest, schools compete against other schools within their grade division to win cash prizes.

Photo AIV-2

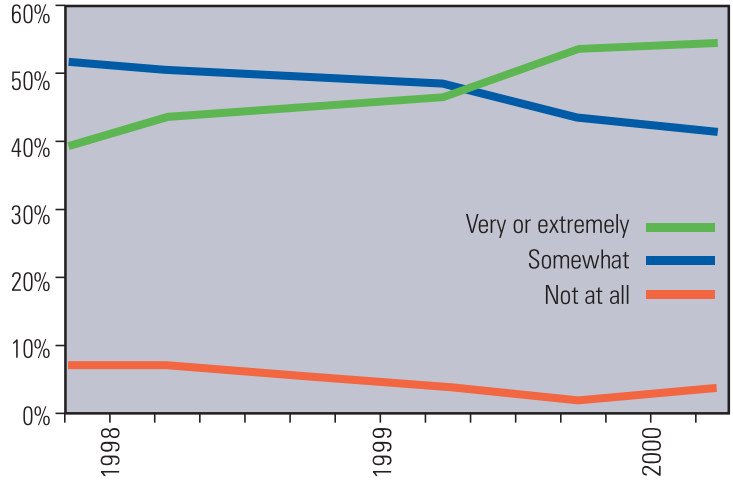
In 2002 the Solid Waste Association of North America awarded BWPRR the Gold Award for Excellence in School Curriculum and the Silver Award for Excellence in Public Education.

Survey of Citizen Knowledge

Survey research over five years shows that both self-assessed and tested knowledge regarding recycling was solid, and in many cases, slowly and steadily increased along with the diversion rate (Chart AIV-2 and Table AIV-1). More information on the measured impact of public education can be found in BWPRR's *Recycling: What Do New Yorkers Think?* (published in the Fall of 1999 and available on the Department's website).

Surveys administered to thousands of New Yorkers revealed that while

Chart AIV-2
Answer to Question, "How Knowledgeable Are You About NYC's Recycling Program?"



Source: DSNY Market Research 1997–2000.

Table AIV-1
Respondents' Identification of Items Currently Accepted in the Recycling Program

	Sep '97	Jan '98	Jan '99	Jul '99	Jan '00
Recyclable items					
soda cans	95%	96%	97%	96%	98%
plastic milk/water jugs	91%	93%	93%	96%	98%
glass bottles	89%	93%	90%	92%	90%
aluminum foil	82%	78%	81%	77%	79%
shampoo/lotion bottles	75%	79%	84%	86%	85%
paper bags	82%	86%	85%	82%	84%
cereal boxes	79%	81%	85%	86%	86%
paperback books	79%	81%	86%	78%	86%
mixed paper	76%	84%	74%	78%	78%
discarded mail	71%	72%	71%	82%	76%
wire hangers	49%	47%	54%	59%	61%
old appliances	38%	48%	50%	58%	43%
Nonrecyclable items					
plastic bags	67%	67%	63%	64%	64%
yogurt containers	62%	68%	68%	71%	71%
hardcover books	59%	69%	71%	71%	75%
bottle caps/jar lids	52%	56%	58%	66%	62%
ceramics/mirrors/glassware	49%	55%	57%	54%	56%
styrofoam cups/plates	43%	48%	45%	47%	55%
light bulbs	41%	37%	35%	38%	36%
batteries	31%	38%	29%	34%	33%

Source: DSNY Market Research 1997–2000.

some areas of education needed improvement (concerning incorrect identification of certain non-designated plastics and glass as recyclable), overall, New Yorkers were well informed about recycling, viewed the recycling program favorably, and felt good about recycling's community and environmental benefits. It should be noted that DSNY's five-year survey of nearly 5,000 residents is the only study of its kind to measure public education impact at the municipal level. Most cities assess public education success anecdotally, or indirectly by attributing diversion success to public education efforts.

It should be noted that since the suspension of plastics and glass from the recycling program in 2002, confusion about the program has increased. (There is anecdotal, though not survey, evidence to support this.) Now that the full program has been reinstated, reeducating New Yorkers is a priority. The box below summarizes the various publicity efforts BWPRR has undertaken to inform New Yorkers about the full restoration of the City's recycling program.

2004 Advertising Campaign to Inform NYC Residents about the Return of Glass and Weekly Recycling Collection

Direct mail: BWPRR sent a direct mail piece to NYC residents, building superintendents, building management companies, and City agencies and institutions that contained information on the latest recycling requirements. Over 3.4 million pieces were mailed in April 2004.

Newspaper ads: From March to April 2004, two full-page, color ads ran in the City's major daily papers, as well as the City's three Spanish language dailies. Two issues of the Sunday *New York Times* contained a full-page, color fold-out of recycling regulations, and full-page ads appeared in community papers in each borough.

Telemarketing campaign: In conjunction with a telemarketing company, BWPRR sent a 30-second, recorded voice message to NYC residents. The message contained information about the materials that should be recycled and directed people to dial 311 for more information. More than 1.5 million messages were delivered during the second half of April 2004. A second campaign about enforcement will occur in June 2004.

Radio ads: From April 12 through June 21, more than 3,600 radio spots were scheduled to run in over 24 stations. The radio spots included versions of the telemarketing message sent to City residents.

TV ads: From April 19 through May 24, a total of 748 recycling ads appeared on cable and network stations. The ads featured the two animated TV spots developed in Spring 2001.

Municipal pay stubs: For the month of May, pay stubs for all municipal employees had the following message: *Glass and Weekly Recycling are Back.*

Email: In March 2004, BWPRR sent an html email announcement to district managers, borough presidents, and NYC council representatives informing them of the changes to the recycling program. The email included information on the upcoming publicity campaign and how to order bulk quantities of recycling decals and flyers for their offices. An official announcement was also sent through the City's official website, NYC.gov, to the more than 30,000 users who have signed up to receive newsletters through NYC.gov.

Truck posters: All DSNY collection vehicles displayed truck posters advertising the return of glass recycling.

Water-bill inserts: BWPRR made an arrangement with the NYC Department of Environmental Protection to insert notices about recycling and waste prevention with the over 800,000 water bills that they send to NYC customers.

Grocery store bag stuffers: BWPRR worked with the Food Industry Alliance to place notices about recycling and waste prevention into grocery bags. Participating grocery stores included D'Agostino, Food City Markets, Gristedes, Met Food Stores, Pathmark, Pioneer Food Stores, Stop & Shop, and The Food Emporium.

Clear bag campaign: To inform residents about the use of clear recycling bags, BWPRR produced shelf and window displays that will be placed in grocery, drug, and hardware stores.

Go Poster campaign: Recycling and waste-prevention posters appeared in all NYC "Go Poster" locations from April through June 2004.

New materials: To help support the recycling message, BWPRR printed recycling bumperstickers, which can be ordered through 311 and the Department's website. BWPRR also printed new t-shirts and hats to match the design of the bumperstickers, which will be distributed during special events.

What Can NYC Learn from Other Jurisdictions and Its Own Citizens?

Given that three independent measures of New York's past public education efforts (spending, diversion rate, and surveyed knowledge) show it to have been more than adequate through 2002, it is important to think carefully about how changes to recycling public education would translate to specific outcomes. Had there been no increase in diversion between 1997 and 2002, or if levels of knowledge about recycling had been very low, the argument might be made that a wholesale revision of public education is in order. Evidence is abundant, however, that this has not been the case. Nonetheless, the approach that dominates past and current debate on the issue consists of general calls to "improve recycling in New York City" by "improving public education." We believe the approach needs to evolve beyond this level of advocacy.

This is not to say that the City's public education program should never change—clearly, innovation and restructuring are crucial to keeping public education current and attention-grabbing. The City's approach to public education has evolved over the years, and will continue to evolve. As it does, the applicability of introducing ideas like block captains, phone-banking, newsletters, or other methods in use in other jurisdictions should be considered. But there is a difference between this approach to innovation and one that simply says, "in other cities they have program element X, and they have a higher diversion rate, so we should implement program element X here."

Overall, there is simply no reason to conclude that higher diversion will result from major changes to the recycling public education approach the City has used in the past. As both Appendix II and the main body of this report have shown, New York's diversion rate has been comparable to the paper, metal, glass, and plastic diversion rates of other cities. The problems New York City has faced in regard to recycling have been economic and infrastructural. Clearly public education is very important, and continuing creativity in program development will be needed. But what should be reassessed in future debate is the notion that there are large, untapped gains in diversion to be achieved by somehow changing the way public education and outreach are carried out in New York City.

Post Script—Enforcement

Unlike recycling public education, recycling enforcement in New York City is quite different than in other municipalities. Here the mandatory recycling law specifies tickets and fines for noncompliance. In many other cities, including Seattle, San Francisco, and Chicago, recycling participation is voluntary. Contamination of recycling set outs with trash is handled by leaving materials at curbside with a note, or, with larger apartment buildings, speaking with building managers. If contamination persists, the resident or building is simply dropped from collection service.

Why does NYC take a different approach? Its demographics require it. With 8 million residents and a density far exceeding any other U.S. city, leaving materials at curbside is not an option. Moreover, with over 70 percent of the City's nearly 3 million housing units in buildings of five or more apartments, building owners and superintendents take on a great deal of responsibility for recycling compliance. Given the difficulty of identifying noncomplying tenants, the City's recycling laws hold apartment building owners/managers responsible for correctly setting up a recycling area and placing materials at curbside, but do not generally enforce rules governing what is in the bin or bag. Such violations are more frequently issued to residents of single- or two-

family homes, where compliance at that level can be tied to the individual waste generator. Under this approach, the Department currently issues an average of about 10,000 notices of violation for residential recycling per month. There are currently around one hundred Enforcement Officers who work full-time on this endeavor.

Appendix V
NYC Department of Sanitation ANNUAL RECYCLING REPORT for 2002 submitted to the NYS Department of Environmental Conservation

47-15-51A(1/03)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID & HAZARDOUS MATERIALS

ANNUAL RECYCLING REPORT

1. Calendar year: 2002

2. Solid Waste Management Planning Unit or Reporting Municipality:
New York City Department of Sanitation

3. Legal Form of Entity (i.e., Authority, Department, Agency, etc.): Agency

4. Address:
Bureau of Waste Prevention, Reuse and Recycling
Dept. of Sanitation
44 Beaver Street, 6th Floor
New York, NY 10010

Phone: (212) 837-8156 Fax: (212) 837-8026

Email address: rwlange.nycrecycles@verizon.net

☑ Please check here if you do not want your email address printed in the NYS Recycling Bulletin.

5. Counties or Towns (names) that comprise planning unit: Counties: Bronx, Kings, New York, Queens, Richmond

6. Total Population: 8,008,278

7. Number of Towns: N/A

8. Number of Villages: N/A

9. Cities (names): New York City

10. Program Contact Person & Title: Robert Lange, Director

Department Head & Title: John J. Doherty, Commissioner

11. For responses 12 & 13, please state if data is actual measurements (i.e., scale data), estimates (i.e., from SWMP) for other source (explain): scale data, self-reported, and estimates - see Note 1 to page 1, at end of document.

12. Solid waste generated within the planning unit for the reporting calendar year: (NHIW: Non-Hazardous Industrial Waste; C&D: Construction & Demolition Debris) (Total Generated=Total Recycled (Grand Total from Page 8)+Total Disposed (#13 on Page 1))

MSW: 6,131,349.00 C&D: 9,760,299.00 NHIW:

Sewage Sludge: 540,488.00 Total Tons Generated: 16,432,136.00

13. Quantity and method of disposal for all waste generated by the planning unit (PU):

	Landfilled		Waste-to-Energy		Other or Unaccounted for (describe): see note 2 to page 1, at end of document.
	(Inside PU)	(Outside PU)	(Inside PU)	(Outside PU)	
MSW					5,471,452.00
C&D					1,509,837.00
NHIW					
Sewage Sludge					0.00
Total:	0.00	0.00	0.00	0.00	6,981,289.00
				Grand Total:	6,981,289.00

14. Material received for recycling from outside of planning unit or reporting municipality. (*For information purposes only. This is not calculated as part of the recycling rate.*) Outside entities (municipality or private source):

Grand total: 0.00

Notes:
1. Planning Unit data are scale weights recorded for calendar year 2002. Private generator data are a mixture of self-reported and estimated. Most private sector data are for calendar year 2002, but when annual was not available, Fiscal Year (FY) data covering July 1, 2001 - June 30, 2002 were used.

2. Method of disposal is not recorded for Planning Unit or private generators.

15. ☐ Please check if your planning unit has an approved Comprehensive Solid Waste Management Plan and there have been no program changes.

If you have had any changes to your local laws governing recycling, msw and enforcement of solid waste/source separation/recycling laws please describe.

Per Local Law 11 of 2002, curbside/containerized recycling of plastic and glass containers with commingled recycling was suspended as of July 1, 2002. Curbside collection of household metal and paper (in two separate streams) continued.

Residential leaf collection suspended for 2002.

Copy of Local Law 11attached.

Copy(s) of any new law(s) appended ☑

16. There are many issues that can account for program differences resulting in variations of recycling rates. If you would like, provide an explanation below that characterizes your planning unit. This will help us to provide more information about planning units than just a recycling rate.

The New York City Planning Unit is the Department of Sanitation (DSNY), which manages New York City's. residential and public institution waste streams. These streams include MSW generated by residents and institutions, and C&D generated by institutions. Sewage sludge is separately managed by the Department of Environmental Protection (DEP). Commercial waste, including MSW, C&D and sludge, is managed privately.

Due to the mid-year suspension of glass and plastics from the DSNY curbside/containerized recycling program, the MSW diversion rate for the DSNY managed waste stream was 14%, down from roughly 20% the year previous. This MSW diversion rate reflects the recycling of metal, glass, plastic, paper and a very small amount of food and special wastes from the MSW stream that residents and institutions generate. It should be noted that the 14% rate is also down due to the suspension of leaf composting program in 2002. However, since only 4% of NYC's MSW stream is yard waste (as compared to 25% nationally), leaf and other yard waste composting programs -- when fully operational -- only minimally contribute to MSW diversion in New York City. When comparing NYC's MSW diversion rate to other municipalities with significant fractions of yard waste in their MSW, this fact should be borne in mind.

The recycling rate for the C&D portion of the DSNY-managed waste stream is 100%, as is the recycling rate for DEC sewage sludge. Thus the overall recycling rate for the PU is 39%. Factoring in commercial recycling of MSW, C&D and sludge, as calculated on page 9, raises diversion to 59%.

If there is not enough room on page 1 or on any of the other pages, please answer on a separate 8 ½" x 11" sheet. Use the number corresponding to the question when answering.

General Definitions

Recyclables: those materials recovered from the solid waste stream and transported to a processor or end user for recycling. (National Recycling Coalition, 1995)

Recycling: the series of activities by which recyclables are collected, sorted, processed and converted into raw materials and used in the production of new products. Excludes the use of these materials as a fuel substitute or for energy production.

Reuse: the use of a product or component in its original form for its original purpose, more than once. Examples include: refilling glass or plastic bottles, repairing wood pallets, using corrugated or plastic containers for storage, and returning milk crates.

Additional definitions regarding specific materials are included in Appendix A and B.

Instructions

The attached standardized report forms have been developed to ensure consistent, accurate and complete information. Forms A and B provide for reporting both municipal program (planning unit/system) recycling and non-program/private recycling.

The following appendices are attached at the end of this package to assist in identifying, defining and quantifying recyclables:

Appendix A:	Description of Component Categories
Appendix B:	Material handling of special or unique materials considered recycling (applicable to percentages and goals)
Appendix C:	Volume to weight conversion factors
Appendix D:	Industrial Wastes

Form A

Recyclables are those materials which would, unless recycled, be disposed of in a refuse disposal system. Material categories are described in Appendix A and B.

Planning units must report quantities for individual material categories wherever possible. Totals may be used only when the breakdown is unknown.

Column categories:

Column 2
Solid waste management program or planning unit recycling (Column 2) is that which is operated under the authority of a planning unit. Report mandatory curbside and drop off program material here if it is managed by the planning unit/system. Mark the tonnage with an "M" mandatory or a "V" for voluntary. Materials that are recycled at private facilities, independent of any planning unit contract, should be reported under columns 3 and 4. These would be materials not accepted at a municipally owned MRF; for example, white goods. If a material is a mandated recyclable and is recycled at a private facility, it should be reported under column 3. If a material is not a mandated recyclable being recycled through a private facility, it should be reported in column 4.

Column 3
Column 3 is that mandated recycling which is generally managed by the private sectors, and often includes commercial, industrial or institutional generators which place their recyclable materials with private recyclers. An example may be a local law requiring commercial office paper recycling without any provision by the planning unit/system to handle or contract for the handling of such material. The non-system tonnage may also be reported by generators or recyclers. Care must be taken not to double count material.

Column 4
Non-program non-mandated recycling (Column 4) is that which takes place even though there is no system/planning unit requirement to recycle the specific materials. An example would be a special industrial waste, such as brewer's grain or foundry sand.

Column 5
Place totals from across the row in this column. Total of this column should equal grand total.

Instructions for Reporting Bottle Bill Tonnages

It is very important that these instructions are followed to avoid any double counting. We utilize the figures on redeemed containers received from surveys completed by distributors (deposit initiators) to calculate New York State's recycling data.

If you are reporting any returnable beverage containers that have been redeemed through the New York State Returnable Container Act, enter that information in the Deposit Containers Category on Form A Page 7. Also, please indicate the method used to calculate this redemption data (i.e., estimate of containers redeemed in the planning unit, information obtained from redemption centers, planning unit sorted and redeemed the containers; include whether it is an estimate of the number of units, estimate of weight or scale data).

Deposit containers that are not redeemed but are recycled along with other collected materials should be included in the total tonnages of the appropriate category of material.

Which Column to Use:

Column 2 - Report containers that have been handled and redeemed by the planning unit. (Examples, the planning unit sorts unredeemed deposit containers that have been placed in recycling bins and then takes them to a redemption center to receive the five-cent per container refund or the planning unit actually operates a redemption center.) **This data can be included in the total amount recycled for the planning unit.** The data from this category will be added to the appropriate category of material(s) (i.e., commingled, plastic, aluminum, and/or PET #1) and included in your final summary report published in the New York State Annual Recycling Bulletin.

Column 3 - Non-program/private mandated recycling - If you choose to report containers that have been redeemed in your planning unit but have not been handled by the planning unit. (Examples, you have contacted redemption centers for the number of containers redeemed in your planning unit or you are estimating based on your county's population.) **This total is not to be included in your total amount recycled and therefore should not be used to calculate your recycling rate.**

Form B

Recycling Rate -This form provides the formula for determining the recycling rate.

This form also provides for reporting both planning unit/municipal program waste reduction and reuse and non-program/private waste reduction and reuse. It is provided so that you may document reuse and waste reduction activities.

*Please see Appendices A and B for descriptions of material categories.

FORM A

RECYCLING REPORT

for the calendar year 2002

Report only outgoing and marketed materials, not incoming.
Exception: yardwaste and other compostables should be reported as incoming.

Material categories	(1) Material	(2) Planning Unit/System Solid Waste Program Recycling tons Mandatory (M) or Voluntary (V)	M or V	(3) Non-program/private mandated recycling in tons	(4) Non-program/ private non-mandated recycling in tons	(5) Total Tons
PAPER	Newspaper	237,028.00	m	see total		237,028.00
	#6 Mix					0.00
	#8 Mix					0.00
	Mixed Paper	37,096.00	m			37,096.00
	Mixed Paper (animal bedding only)					0.00
	Magazines					0
	Corrugated Cardboard	88,886.00	m			88,886.00
	Kraft Paper					0.00
	Gable Top/Drink Boxes					0.00
	Paperboard Chipboard/Boxboard					0.00
	Hardcover Books					0.00
	Softcover Books					0.00
	Office Paper	61.00				61.00
	"Junk Mail"					0.00
	Telephone Directories					0.00
	Commingled Paper (Specify) see note 1 to page 5, at end.			171,000.00		171,000.00
	Other Paper (Specify)					0.00
	PAPER TOTAL	363,071.00		171,000.00	0.00	534,071.00

PAGE TOTAL	363,071.00	171,000.00	0.00	534,071.00

FORM A (Continued)

Material Categories	(1) Material	(2) Planning Unit/System Solid Waste Program Recycling tons Mandatory (M) or Voluntary (V)	M or V	(3) Non-program/ private mandated recycling in tons	(4) Non-program/ private non-mandated recycling in tons	(5) Total Tons
PLASTIC	PET #1					0.00
	HDPE #2					0
	LHDPE #2					0.00
	PVC #3					0.00
	LDPE #4					0.00
	LLDPE #4					0.00
	PP #5					0.00
	PS #6					0.00
	Mixed Plastic (specify) see Notes 1 and 2 to p. 6, at end		m			0.00
	Other Plastic (specify)					0.00
	PLASTIC TOTAL	0.00		0.00	0.00	0.00
ORGANICS (Yard waste listed separately below)	Food Waste	5,151.00	v			5,151.00
	MSW Compost					0.00
	Other Organic	1,636.00	v			1,636.00
	ORGANICS TOTAL	6,787.00		0.00	0.00	6,787.00
METAL Ferrous	Ferrous and Bi-metal Food Containers (inc. aerosol cans)	46,549.00	m			46,549.00
	Enameled Metal Appliances (white goods)	48,481.00	m			48,481.00
	Whole Autos and Parts	14,453.00	m			14,453.00
	Other Ferrous					0.00
	FERROUS TOTAL	109,483.00		0.00	0.00	109,483.00
Non-ferrous	Aluminum Cans/Foil					0.00
	Other Aluminum					0.00
	Other Non-Ferrous					0.00
	NON-FERROUS TOTAL	0.00		0.00	0.00	0.00
PAGE TOTAL		116,270.00		0.00	0.00	116,270.00

Notes
1. Between January 1 and June 30, 2002, PU recycling data were collected for commingled metal, glass and plastic. Between July 1 and December 31, 2002, data for commingled metal (ferrous and nonferrous) only were collected. Column 2 data above show estimated and measured tonnages for commingled metal. Commingled plastic and glass tonnages are reported in the commingled category on page 7, Col. 2.

2. Paper and Commingled metal, glass and plastic are reported together by commercial, private MSW transfer stations. Tonnages are reported in the commingled category on page 7, Col. 3.

FORM A (Continued)

Material Categories	(1) Material	(2) Planning Unit/System Solid Waste Program Recycling tons Mandatory (M) or Voluntary (V)	M or V	(3) Non-program/private mandated recycling in tons	(4) Non-program/ private non-mandated recycling in tons	(5) Total Tons
GLASS	Glass - Clear					0.00
	Glass - Green					0.00
	Glass - Brown					0.00
	Glass - Mixed					0.00
	Glass - Plate					0.00
	Other Glass					0.00
	GLASS TOTAL	0.00		0.00	0.00	0.00
COMMINGLED	Glass, metal, plastic containers, other (specify) See Notes 1 and 2	112,565.00	m	63,688.00		176,253.00
DEPOSIT CONTAINERS* This data is optional. See Page 4 for **important** reporting instructions.	PET#1					Column 2 Total Only 0.00
	GLASS					Column 2 Total Only 0.00
	ALUMINUM					Column 2 Total Only 0.00
	COMMINGLED					Column 2 Total Only 0.00
	DEPOSIT CONTAINERS TOTAL	Add to the page and grand total 0.00		Do not add to the page and grand total 0.00		Column 2 Totals Only 0.00
	Method used to calculate this data (see page 4 instructions):	see note 3 to page 7				
RUBBER	Rubber, tires	3,878.00	m			3,878.00
	Other rubber					0.00
	RUBBER TOTAL	3,878.00		0.00	0.00	3,878.00
TEXTILES	Textiles/leather	182.00	v			182.00
WOOD	Wood Pallets					0.00
	Wood-Lumber					0.00
	Other wood (including C&D wood)					0.00
	WOOD TOTAL	0.00		0.00	0.00	0.00
CONSTRUCTION & DEMOLITION DEBRIS (C&D)/ INERT/ CONTAMINATED SOIL	Asphalt	207,191.00	m			207,191.00
	Concrete/Brick/Rock/Fines	920,756.00	m			920,756.00
	Other C&D/Inert	3,424.00	m		7,119,090.00	7,122,514.00
	Contaminated Soil					0.00
	C&D/INERT/SOIL TOTAL	1,131,371.00		0.00	7,119,090.00	8,250,461.00
PAGE TOTAL		1,247,996.00		63,688.00	7,119,090.00	8,430,774.00

FORM A (Continued)

Material Categories	(1) Material	(2) Planning Unit/ System Solid Waste Program Recycling tons Mandatory (M) or Voluntary (V)	M or V	(3) Non-program/ private mandated recycling in tons	(4) Non-program/ private non-mandated recycling in tons	(5) Total Tons
YARDWASTE (including yardwaste to be composted) Report as incoming only	Leaves	0.00				0.00
	Grass				5,909.00	5,909.00
	Brush					0.00
	Wood-Stumps					0.00
	Mixed yardwaste					0.00
	Other yardwaste					0.00
	YARDWASTE TOTAL	0.00		0.00	5,909.00	5,909.00
BATTERIES, HHW & PAINT	Lead Acid Batteries	67.00	m			67.00
	Dry Cell Batteries	3.30	v			3.30
	Paint					0.00
	Misc. Solvents					0.00
	Other Household Hazardous	9.80	v			9.80
	BATT., HHW, PAINT TOTAL	80.10		0.00	0.00	80.10
REFRIGERANTS	Refrigerants	5.33	m			5.33
SLUDGES	Sewage Sludge (wet tons)	524,848.00				524,848.00
	Water Treatment Plant Sludge					0.00
	Paper Mill Sludge				15,600.00	15,600.00
	SLUDGES TOTAL	524,848.00		0.00	15,600.00	540,448.00
OIL, ANTIFREEZE	Used Motor Oil	33.78				33.78
	Used Oil Filters	129.16				129.16
	Antifreeze					0.00
	Other (specify; such as vegetable oils)					0.00
	OIL & ANTIFREEZE TOTAL	162.94		0.00	0.00	162.94
OTHER INDUSTRIAL	Specify material (type and quantity) on separate sheet. See Appendix D for examples					0.00
PAGE TOTAL		525,096.37		0.00	21,509.00	546,605.37
GRAND TOTAL		2,252,433.37		234,688.00	7,140,599.00	9,627,720.37

The above information was determined from: Scale data: ☐ Estimates: ☐
Combination of actual measurements and estimates: ☑

FORM B

FORMULA FOR DETERMINING RECYCLING RATE:

Total tons recycled (Grand Total from Column 5, Form A) = A = 9,627,720.37

Total tons solid waste generated (Item 12, cover sheet) = C = 16,432,136.00

RECYCLING RATE = A ÷ C x 100% = 59%

WASTE REDUCTION AND REUSE

See Below for Source Reduction Strategies
Please include methods even if tonnages are unknown.
(Examples: Report pallet reconditioning and textiles reused here.)

METHOD OF REDUCTION	MATERIALS	TONS (if available)
EDUCATIONAL	curriculum guide for NYC schools	
	website, reuse hotline, printed materials	
	community coordinators	
BUSINESS/INSTITUTIONAL ASSISTANCE	website, printed materials, waste audits,	
	materials exchange program	
Grand Total:		0.00

SOURCE REDUCTION STRATEGIES

Use to describe waste reduction and reuse activities.

EDUCATIONAL STRATEGIES
- Elementary/Secondary School Curricula
- Home Composting/Leave It On The Lawn Campaign
- Consumer Source Reduction Shopping Tips
- Junk Mail Reduction Campaign
- Source Reduction Literature, News Articles, Events, etc.

UNIT PRICING
- Pay By Weight or Volume
  - •Residential
  - •Institutional/Government

STRATEGIES FOR BUSINESSES/INSTITUTIONS
- Waste audits to identify source reduction opportunities
- On-site Business/Institutional composting
- Programs to reduce office paper waste
- Promote business purchasing policy change
- Promote operational changes
- Source reduction for specific sectors
- Reuse, repair and exchange centers

LEGISLATION/REGULATION
- Source Reduction Procurement Policies
- Packaging Regulations
- Bans at disposal facilities
- Hazardous Materials Labeling Regulations

Appendix A

DESCRIPTION OF COMPONENT CATEGORIES

Material	Component Categories	Examples
Paper	Newspaper	Daily, weekly newspapers
	#6 Mix	Newspaper that may include certain amounts of other paper materials depending on mill specs.
	#8 Mix	Newspaper that may include inserts and magazines, but does not include paper such as any brown fibers or mixed paper.
	Mixed Paper (animal bedding only)	Newspaper, magazines, telephone directories and other mixed paper that will be processed for animal bedding.
	Magazines	Periodicals, journals, catalogs and glossy publications.
	Corrugated Cardboard	Multi-layer kraft corrugated shipping boxes and inserts.
	Kraft Paper	Grocery bags and other brown paper bags.
	Gable Top/Drink boxes	Milk and juice paper cartons and aseptic packaging.
	Paperboard/Chipboard/Boxboard	Cereal boxes, shoe boxes, gift boxes and other lightweight cardboard.
	Hardcover Books	Books and novels with hard covers.
	Softcover Books	Books and novels with soft covers.
	Office Paper	Copy paper, computer printout, ledger and letterhead paper.
	Junk Mail	Direct mail, flyers, brochures, envelopes, sweepstake forms, coupons, magazines, school paper and office paper.
	Telephone Directories	Soft cover telephone books both, yellow and white pages.
	Commingled	Mixed recyclable paper, news, junk mail, magazines, etc.
	Other Paper	Tissue paper, towels, or as specified.
Plastic	PET (#1)	Soda bottles, liquor bottles.
	HDPE (#2)	Milk jugs, shampoo bottles.
	LHDPE (#2)	Grocery bags.
	PVC (#3)	Oil bottles, salad dressing.
	LDPE (#4)	Margarine tubs, coffee can lids, mustard containers.
	LLDPE (#4)	Dry cleaning bags, trash bags.
	PP (#5)	Yogurt cups, squeeze-it (burst) bottle.
	PS (#6)	Cups, egg cartons, packing foam.
	Other Plastic	Ketchup bottles, pancake syrup.
Organics	Food Waste	Kitchen scraps, dog food, food processing wastes.
	Other Organics	Brewery waste, fish processing waste.

Appendix A (Continued)

Material	Component Categories	Examples
Ferrous Metal	Food Containers/Bi-metal (inc. Aerosols)	Pet food cans, soda cans, hair spray.
	White Goods/Enameled	Household appliances.
	Auto and Auto Parts	Whole autos, pumps, fenders, doors.
	Other Ferrous	Coat hangers, scrap metal.
Non-Ferrous Metal	Aluminum Cans/Foil	Soda cans, beer cans, pie plates, foil.
	Other Aluminum	Siding, cookware, machine parts.
	Other Non-Ferrous	Eating utensils, electrical wiring.
Glass	Clear Containers	Soda bottles, pickle jars.
	Green Containers	Beer bottles, wine bottles.
	Brown Containers	Beer Bottles, wine bottles.
	Plate Glass	Auto glass, window glass.
	Other Glass	Ceramic glass, light bulbs.
Wood	Pallets	Forklift pallets.
	Lumber	Plywood sections, particle board.
	Other Wood	Crates, sawdust, animal bedding.
Rubber	Rubber	Tires, inner tubes, housewares.
Textiles	Textiles/Leather	Clothes, drapes, shoes, rugs.
Inert	Asphalt - shingles	Roofing, siding.
	Asphalt - paving	Road surfacing.
	Concrete/Brick/Rock	Gravel, house bricks, stones.
	Contaminated Soil	Soil, sand.
	Other Inert	Sheetrock, plaster, insulation.
Yard waste	Leaves	Foliage.
	Grass	Lawn clippings.
	Wood - stumps	Logs and tree stumps.
	Other Yard Waste	Prunings, brush.
Household Hazardous Waste, Batteries, Paint	Lead/Acid Batteries	Auto batteries, marine batteries.
	Dry Cell Batteries	Radio batteries, flashlight batteries, lithium, nickel-cadmium, mercuric oxide and silver oxide button cell batteries, and small sealed lead-acid rechargeable batteries.
	Household Hazardous Waste	Solvents, pesticides.
	Paint	Latex & oil-based paints.

Appendix B

Material handling of special or unique materials, considered recycling (or waste reduction/reuse) by the Department of Environmental Conservation.

Materials	Acceptable
Metals	Lead acid batteries, i.e., automotive batteries. Ferrous or non-ferrous materials recovered from waste stream at a MSW disposal facility.
	Ferrous and non-ferrous metal recovered post incineration. Any other metals deemed acceptable by the NYSDEC.
Glass	Glass used for leachate collection, landfill cover and landfill gas venting. Cover must be approved by DEC. Cover includes daily, intermediate and final [Part 360-1.15(b)(1) and Part 360-2]. Uncontaminated glass when used as a substitute for conventional aggregate in asphalt or subgrade applications. Material must substitute for an analogous raw material and not constitute disposal.
Paper	Office/Computer paper. Any paper typically found in an office that is not contaminated by glue, plastic or other foreign matter (e.g., computer print out green bar/blue bar) white or colored writing paper, copier paper, etc.) Magazines. Any coated publication (e.g., magazines, catalogues, etc.)
	Mixed paper. Any combination of the above or any other papers that are recycled e.g., telephone directories, window envelopes, books, bulk mail, paperboard, kraft paper. Paper, sewage and other sludges used for landfill cover and C&D material used for landfill cover, PROVIDED A BENEFICIAL USE DETERMINATION (BUD) OR OTHER DEPARTMENT OF ENVIRONMENTAL CONSERVATION (DEC) APPROVAL HAS BEEN OBTAINED.
Commingled Compost/Mulch	Any combination of food, beverage, detergent or other containers made from glass, plastic and/or metal. Tonnage documentation of yard waste at time of collection, as long as there is evidence that material will be composted/mulched and marketed. Compost/mulch is considered to be marketed when the material is sold, given away or used in lieu of soil or other soil amendments.
	Grass - clippings from residential or commercial sources. Leaves - from residential or commercial sources. Brush/Branches - small trimmings from trees and shrubs from residential and/or commercial sources. Mixed - any combination of above. Compost used for landfill cover. Compost made on-site from waste brewers grain, prison food waste, manure, etc. and used on-site or off-site or compost made from backyard composting.

Appendix B (Continued)

Material	Acceptable
Wood	Wood material [waste lumber, (residential sources), pallets, crates, etc.] that is chipped and used to create a raw material or product that is returned to the marketplace or used in lieu of purchased materials is acceptable NYSDEC tonnage. Pallets that have been refurbished by actually replacing pieces of the pallet can be counted, such as for waste reduction. (Wood chipped and used as fuel is not to be counted.)
Animal and Vegetable Fat	Solid animal fats which are recycled. Grease/oil from restaurants etc., and animal renderings which are reprocessed (such as for animal feed).
Asphalt	Recycling asphalt into new asphalt.
Ash	Ash used for any DEC BUD approved uses. Bottom ash used as road sand, PROVIDED BUD OR OTHER DEPARTMENT APPROVAL HAS BEEN OBTAINED. Materials recovered from bottom ash, such as glass, metals, etc.
Food	Outdated or postdated foods to farmers as feed supplement or for food banks.
Textiles	Verification must be obtained as to the destination and use.
Batteries	Only dry cell batteries that are actually recycled (and not just collected) qualify. Typically, these are mercuric oxide and silver oxide button cell batteries, nickel-cadmium and small sealed lead-acid rechargeable batteries. Large lead-acid (i.e., vehicle) batteries can be assumed to be 100% recycled.
HHW	Only HHW that is actually recycled (and not just collected) qualifies.
Oil	Only oil that is actually recycled (and not just collected) qualifies. Most vehicle oil is reprocessed for burning.
Tires	Tires that are recapped, remanufactured or otherwise made into raw material or product may count toward recycling. Tires chips may be counted when used for civil engineering projects, such as road embankments, PROVIDED BUD OR OTHER DEPARTMENT APPROVAL HAS BEEN OBTAINED. Material must substitute for an analogous raw material and not constitute disposal.
Scrap Automobiles	Scrapped vehicles generated within the jurisdiction and recycled.
Scrap Metal	Ferrous and non-ferrous from industrial, etc., generators.
Waste Grain	Waste grain (e.g., "spent hops") waste whey, etc., used for animal feed.
Other	Septage, yard waste, sludge, food/food processing waste etc., used for proven beneficial uses (such as agricultural, horticultural and silvicultural applications). Compost; paper, sewage, water treatment plant and other sludges; C&D materials; and other materials used for landfill covers, PROVIDED BUD OR DEC APPROVAL HAS BEEN OBTAINED. To count landfill cover material toward recycling, it must substitute for a soil cover material that would, otherwise, have to be brought in from off-site. DEC approved BUDs not noted above. Only those BUDs [either Part 360-1.15(b) or case-specific Part 360-1.15(d)] that are not for energy use (such as TDF or other non-recycling uses) are acceptable.

Appendix C

Volume to Weight Conversion Factors

MATERIAL	EQUIVALENT	
GLASS-whole bottles	1 cubic yard	0.35 tons
GLASS-semicrushed	1 cubic yard	0.70 tons
GLASS-crushed mechanically	1 cubic yard	0.88 tons
GLASS-uncrushed-manually broken	55 gallon drum	0.16 tons
NEWSPRINT-loose	1 cubic yard	0.29 tons
NEWSPRINT-compacted	1 cubic yard	0.43 tons
CORRUGATED-loose	1 cubic yard	0.15 tons
CORRUGATED-baled	1 cubic yard	0.55 tons
PAPER-high grade loose	1 cubic yard	0.18 tons
PAPER-high grade baled	1 cubic yard	0.36 tons
PAPER-mixed loose	1 cubic yard	0.15 tons
PLASTIC-PET-whole	1 cubic yard	0.015 tons
PLASTIC-PET-flattened	1 cubic yard	0.04 tons
PLASTIC-PET-baled	1 cubic yard	0.38 tons
PLASTIC-HDPE-whole	1 cubic yard	0.012 tons
PLASTIC-HDPE-flattened	1 cubic yard	0.03 tons
PLASTIC-HDPE-baled	1 cubic yard	0.38 tons
PLASTIC-mixed	45 gallon bag	0.01 tons
PLASTIC-grocery bags	45 gallon bag	0.01 tons
PLASTIC-styrofoam	45 gallon bag	0.01 tons
PLASTIC-styrofoam	1 cubic yard	0.02 tons
ALUMINUM-cans-whole	1 cubic yard	0.03 tons
ALUMINUM-cans-flattened	1 cubic yard	0.125 tons
FERROUS METAL-cans-whole	1 cubic yard	0.08 tons
FERROUS METAL-cans-flattened	1 cubic yard	0.43 tons
WHITE GOODS-uncompacted	1 cubic yard	0.10 tons
WHITE GOODS-compacted	1 cubic yard	0.5 tons

Appendix C (Continued)

MATERIAL	EQUIVALENT	
YARDWASTE-grass clippings-loose	1 cubic yard	0.3 tons
YARDWASTE-grass clippings-compacted	1 cubic yard	0.6 tons
YARDWASTE-leaves-loose	1 cubic yard	0.125 tons
YARDWASTE-leaves-vacuumed	1 cubic yard	0.15 tons
YARDWASTE-leaves-compacted	1 cubic yard	0.25 tons
YARDWASTE-brush-loose	1 cubic yard	0.25 tons
YARDWASTE-brush-compacted	1 cubic yard	0.5 tons
LEAD-ACID BATTERIES-car	one (39.4 lbs)	0.0197 tons
LEAD-ACID BATTERIES-truck	one (53.3 lbs)	0.0267 tons
LEAD-ACID BATTERIES-motorcycle	one (9.5 lbs)	0.005 tons
LEAD-ACID BATTERIES-combination	use average of 34 lbs	0.017 tons
WASTE OIL	1 gallon	0.004 tons
ANTIFREEZE	1 gallon	0.005 tons
WASTE TIRES-passenger car	one	0.01 tons
WASTE TIRES-truck	one	0.03 tons
WOOD - PALLETS	one	0.14 tons
WOOD - loose dimensional	1 cubic yard	0.12 tons
WOOD - compacted dimensional	1 cubic yard	0.35 tons
WOOD - other	1 cubic yard	0.18 tons
TEXTILES-loose	1 cubic yard	0.10 tons

Appendix D

Industrial Waste - sample categories

This is only a guide to assist in filling out the industrial material identification and quantification on Page 8 and is not meant to be an inclusive list.

Absorbent material
Alum recovered from water treatment plants
Animal protein, carcasses, renderings
Ash - bottom
Ash
Ash - fly
Boiler cinders
Boiler slag
Books - unsold and recycled (documented)
Carpet remnants returned for remanufacture
Catalogues
Circuit boards
Cloth/textiles - reprocessed
Contaminated soil
Demolition Debris
Drums - plastic
Drums - steel
Electronic Scrap
Fiberboard
Fluorescent tubes
Foundry waste, may be used in asphalt mix
Furniture
Grain waste from brewery, may be sold for animal feed
Hatchery waste processed into protein supplement
Industrial scrap generated and recycled
Ink
Litho-plates
Masonry
Mattresses - processed and remanufactured
Metal - mixed
MSW for composting
Paint
Pallets (report reconditioning on Form B only)
Paper from manufacturing process
Plastic - Acetate
Plastic - other rigid
Plastic - other flexible
Plastic - nylon
Plastic - lead coated
Plastic - Acrylic
Plastic - ABS
Roof Shingles from manufacturing process
Scrap metal from landfill or incinerator
Sludges
Tires burned as fuel
Tires retreaded and sold
Toner cartridges
Vegetable waste from processor
Zoo stall waste composted

Use this page if there is not enough space for any additional information that you need to include. Use the number corresponding to the question answering.

Notes to page 1

1. Planning Unit (PU) data are scale weights recorded for calendar year 2002. Private generator data are a mixture of self-reported and estimated. Most private generator data are for calendar year 2002, but when annual data were not available, Fiscal Year (FY) data covering July 1, 2001 - June 30, 2002 were used.

2. Method of disposal is not recorded for Planning Unit or private generators.

Note to page 5

1. As with last year's report, entry is based on estimate made available from the one municipally contracted paper mill located in New York City. This firm is not required to report data on material from outside the PU. This entry does not reflect tonnages of recycled paper collected from office buildings and trucked to mills, MRFs or transfer stations outside the municipality.

Notes to page 6

1. For the period January 1 through June 30, 2002, PU recycled commingled metal, glass and plastic. For the period July 1 through December 31, 2002, commingled metal (ferrous and nonferrous) only was recycled. The "Ferrous" category for Column 2 (PU material) on page 6 reflects the sum of tonnages of commingled metal collected in both periods. Commingled plastic and glass tonnages for PU material are reported in the "Commingled" category on page 7, Col. 2.

2. For Col. 3 (primate material), paper, metal, glass and plastic recycled tonnages are reported in the "Commingled" category on page 7.

Notes to page 7

1. Glass for Cols. 2 (PU material) and 3 (private material) is included in the "Commingled" category for each stream.

2. The "Commingled" category reflects commingled glass and plastic for Col. 2, and commingled paper, metal, glass and plastic (excluding paper recycled by NYC mill) for Col. 3.

3. Deposit containers are included in ferrous and commingled categories for Col. 2 on pages 6 and 7, respectively.

4. Col. 3 (private material) data for C&D and INERT materials are reported in one lump sum.

Notes:
1. Planning Unit data are scale weights recorded for calendar year 2002. Private generator data are a mixture of self-reported and estimated. Most private sector data are for calendar year 2002, but when annual was not available, Fiscal Year (FY) data covering July 1, 2001 - June 30, 2002 were used.

2. Method of disposal is not recorded for Planning Unit or private generators.

Appendix VI
COMPARATIVE RECYCLING DATA
for Chicago, Los Angeles, New York, San Francisco, and Seattle

including

Summary of Municipal Recycling Survey
As Reported in *Waste News,* 2000–2004

Annual Waste Stream and Diversion Tonnages
Across Five U.S. Cities

Summary of Waste Management Practices for Five U.S. Cities

Table AVI-1
Summary of Municipal Recycling Survey—Chicago
As Reported in *Waste News,* 2000–2004

Waste News publication Date	Feb-00	Feb-01	Feb-02	Feb-03	Feb-04
	CHICAGO	CHICAGO	CHICAGO	CHICAGO	CHICAGO
Population:	2,802,079	2,802,079	2,896,016	2,896,016	2,896,016
Recycling rate:	47.30%	47.90%	44.90%	44.30%	22.30%
Calculated for year ended:		Jun-00	Jun-01	Jun-02	Jun-03
Rate includes:					
Residential	x	x	x	x	x
Commercial	x	x	x	x	
Other					
Rates by category:					
Residential		26.80%	44.90%	44.30%	22.30%
Commercial		N.A.	N.A.	N.A.	N.A.
Materials included:					
(See key below)					
Paper	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP
Metal	ALC, TC	ALC,TC	ALC, TC	ALC, TC	ALC, TC
Plastic	PET, HDPE, PB	PET, HDPE, PB	PET, HDPE, PB	PET, HDPE, PB	PET, HDPE
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	WOOD, CND	WOOD, CND	WOOD, CND	WOOD, CND	
Automotive					
Hazardous			FLP	FLP	
Organic	YARD	YARD	YARD	YARD	YARD
Other	OIL				
Total tonnage collected:	2,411,165	2,287,708	2,352,418	2,146,321	695,250
By city	275,000	294,909	293,744	283,441	211,228
By contracted haulers	2,136,165	1,992,799	2,058,674	1,862,880	484,022
Tonnage collected per material:					
Paper	608,939	545,499	449,061	378,954	371,146
Metal	533,023	117,168	113,741	108,172	182,064
Plastic	6,722	2,197	3,684	2,791	4,039
Glass	23,321	22,741	22,220	13,347	3,002
Yard trimmings	165,961	176,472	186,396	165,786	134,999
Other	1,073,199	1,423,631	1,577,316	1,477,271	0
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	Weekly	Weekly	Weekly	Weekly	Weekly
Number of households	740,000	740,000	740,000	660,000	660,000
Is program mandatory?	—	No	No	No	No
How are materials collected:	—	Single Source	Source-separated	Source-separated	Source-separated
Program operated by:	—	City crews	City crews	City crews	City crews
Dropoff	No	No	Yes	No	Yes
Number of sites	—	N.A.	5-10	5-10	10
Program operated by:	—	N.A.	Private haulers, not-for-profits	Private haulers, not-for-profits	Private haulers
Multifamily dwelling	No	Yes	Yes	Yes	Yes
Program operated by:	—	Private haulers	Private haulers	Private haulers	Private haulers
Other	None	None	None	None	None
Commercial recycling program offered:		Recycling programs mandatory for owners, property managers	Recycling Program mandatory for property managers; collected by private haulers	Recycling programs mandatory for owners, property managers	N.A.
Recycling goals:					
Mandated goal	No	25% by 2001	0.25	0.25	0.25
Non-mandated goal	40% by 2002	40% by 2002	40% by 2002	40% by 2002	0.4
Goals met	Yes	Yes	Yes	Yes	No
Financial information:					
Recycling budget	N.A.	N.A.	N.A.	N.A.	N.A.
Overall solid waste budget	$139,774,240	$144,152,637	$150,000,000	$160,000,000	$154,000,000
Recyclables revenue	$0	$0	$0	$0	N.A.
Amount spent per resident on recycling	N.A.	N.A.	N.A.	N.A.	N.A.
Recycling budget percentage	N.A.	N.A.	N.A.	N.A.	N.A.

MATERIALS KEY: ABAT – automobile batteries; ALC – aluminum cans; APP – appliances; AUTO – automobiles; BVC – beverage cartons, drink boxes; CND – construction debris; ESRP – electronic scrap; FLP – fluorescent lamps; FOOD – food waste; FRN – furniture; GCON – glass containers; HDPE – HDPE plastic; HH – household hazardous waste; MG – magazines; MP – mixed paper; NP – newspaper; OCC – cardboard, corrugated containers; OP – office paper; PB – plastic bags; PET – PET plastic; TB – telephone books; TC – tin cans; TEX – textiles; WOOD – wood waste; TIRE – tires; OIL – oil, oil filters, grease; YARD – yard trimmings

Note: The data in this table reflect information reported in *Waste News* Municipal Recycling Surveys 2000 to 2004. The Department of Sanitation makes no warrant as to their accuracy with the exception of data on New York City.

Table AVI-1
Summary of Municipal Recycling Survey—Los Angeles
As Reported in *Waste News,* 2000–2004

Waste News publication Date	Feb-00	Feb-01	Feb-02	Feb-03	Feb-04
	LOS ANGELES	LOS ANGELES	LOS ANGELES	LOS ANGELES	LOS ANGELES
Population:	3,579,556	3,579,556	3,694,820	3,694,820	3,694,820
Recycling rate:	44.00%	40.90%	55.50%	39.00%	39.00%
Calculated for year ended:		Jun-00	Jun-01	Jun-02	Jun-03
Rate includes:					
Residential	x	x	x	x	x
Commercial			x		
Other					
Rates by category:					
Residential	—	40.90%	42.00%	39.00%	39.00%
Commercial	—	N.A.	N.A.	N.A.	N.A.
Materials included:					
(See key below)					
Paper	NP, OCC, MG, TB, MP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB MP, OP
Metal	ALC, TC	ALC, TC, APP	ALC, TC, APP	ALC, TC, APP	ALC, TC
Plastic	PET, HDPE	PET, HDPE	PET, HDPE, PB	PET, HDPE, PB	PET, HDPE, PB, BVC
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	WOOD		TEX, WOOD, CND, FRN	WOOD	
Automotive			AUTO		
Hazardous		ESRP	ESRP		
Organic	YARD	YARD	FOOD, YARD	YARD	YARD
Other					
Total tonnage collected:	578,818	691,870	5,331,105	664,045	231,456
By city	578,818	691,870	628,561	664,045	231,456
By contracted haulers	0	0	4,702,544	0	0
Tonnage collected per material:					
Paper	112,120	137,499	821,836	160,366	
Metal	4,737	8,112	912,808	6,836	5,470
Plastic	5,291	2,900	5,573	5,824	6,395
Glass	13,464	19,224	262,641	22,983	25,515
Yard trimmings	405,312	454,803	1,076,657	468,036	6,495
Other	36,436	69,332	2,251,590		39,967
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	weekly	Weekly	Weekly	Weekly	Weekly
Number of households	720,000	750,000	720,000	720,000	740,000
Is program mandatory?	—	N.A.	Yes	No	No
How are materials collected:	—	Commingled, single source	Commingled	Source-separated	Source-separated
Program operated by:	—	City Crews	City Crews	City crews	City crews
Dropoff	No	Yes	Yes	Yes	No
Number of sites		Varies	1	1	N.A.
Program operated by:	—	City Crews	Private Haulers	City crews, private haulers	N.A.
Multifamily dwelling	Yes	Yes	No	Yes	No
Program operated by:	—	City Crews	N.A.	City crews, private haulers	N.A.
Other	None	None	None	None	None
Commercial recycling program offered:		N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	50% diversion by 2000	50% diversion by 2000	50% diversion by 2000	70% diversion by 2020	No
Non-mandated goal	No	No	70% by 2020	No	70% diversion by 2020
Goals met	Mp	No	No	N.A.	No
Financial information:					
Recycling budget	N.A.	80000000	57064000	42400000	43000000
Overall solid waste budget	$82,363,875	$121,000,000	$98,876,690	$89,500,000	$93,305,000
Recyclables revenue	$1,486,675	$1,729,680	$1,500,000	$1,654,730	$2,434,884
Amount spent per resident on recycling	N.A.	22.24	15.44	11.48	11.64
Recycling budget percentage	N.A.	0.066	0.589	0.507	0.461

MATERIALS KEY: ABAT – automobile batteries; ALC – aluminum cans; APP – appliances; AUTO – automobiles; BVC – beverage cartons, drink boxes; CND – construction debris; ESRP – electronic scrap; FLP – fluorescent lamps; FOOD – food waste; FRN – furniture; GCON – glass containers; HDPE – HDPE plastic; HH – household hazardous waste; MG – magazines; MP – mixed paper; NP – newspaper; OCC – cardboard, corrugated containers; OP – office paper; PB – plastic bags; PET – PET plastic; TB – telephone books; TC – tin cans; TEX – textiles; WOOD – wood waste; TIRE – tires; OIL – oil, oil filters, grease; YARD – yard trimmings

Note: The data in this table reflect information reported in *Waste News* Municipal Recycling Surveys 2000 to 2004. The Department of Sanitation makes no warrant as to their accuracy with the exception of data on New York City.

Table AVI-1
Summary of Municipal Recycling Survey—New York
As Reported in *Waste News,* 2000–2004

Waste News publication Date	Feb-00	Feb-01	Feb-02	Feb-03	Feb-04
	NEW YORK	NEW YORK	NEW YORK	NEW YORK	NEW YORK
Population:	7,420,166	7,420,166	8,008,278	8,008,278	8,008,278
Recycling rate:	18.20%	19.70%	20.10%	35.70%	29.90%
Calculated for year ended:	—	Jun-00	Jun-01	Jun-02	Jun-03
Rate includes:					
Residential	x	x	x	x	x
Commercial				x	x
Other				x	x
Rates by category:					
Residential	—	19.70%	20.10%	19.80%	12.70%
Commercial	—	N.A.	0.6	0.44	0.637
Materials included:					
(See key below)					
Paper	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP
Metal	ALC, TC, APP	ALC, TC, APP	ALC, TC, APP	ALC, TC, APP	ALC, TC, APP
Plastic	PET, HDPE	PET, HDPE	PET, HDPE	PET, HDPE	
Glass	GCON	GCON	GCON	GCON	
Bulk	FRN	FRN	FRN	FRN, FOOD, CND	FRN, FOOD, CND
Automotive				AUTO	AUTO
Hazardous					
Organic	YARD	YARD	YARD	YARD	YARD
Other	BVC	BVC	BVC	BVC	
Total tonnage collected:	658,944	749,000	740,000	5,960,496	9,084,060
By city	658,944	749,000	740,000	1,869,000	1,557,000
By contracted haulers	0	0	0	4,091,496	7,527,060
Tonnage collected per material:					
Paper	385,632	423,000	420,000	406,866	351,922
Metal	N.A.	305,000	320,000	532,326*	86,759
Plastic	N.A.	(metal, plastic and	(metal, plastic and	(metal, plastic and	
Glass	N.A.	glass combined)	glass combined)	glass combined)	
Yard trimmings	N.A.	21,000	0	50,000	5,476
Other	—	0	0	879,807	1,112,843
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	weekly/biweekly	Weekly	Weekly	Weekly	Biweekly
Number of households	2,000,000	3,000,000	3,000,000	3,200,000	3,200,000
Is program mandatory?	—	Yes	Yes	Yes	Yes
How are materials collected:	—	Single source	Source-separated	Source-separated	Source-separated
Program operated by:	—	City crews	City crews	City crews	City crews
Dropoff	Yes	Yes	Yes	Yes	Yes
Number of sites	4	4	4	4	4
Program operated by:	—	City crews	City crews	City crews	City crews
Multifamily dwelling	Yes	Yes	Yes	Yes	Yes
Program operated by:	—	City crews	City crews	City crews	City crews
Other	None	None	None	None	None
Commercial recycling program offered:	nc	Commercial establishments must recycle and have it collected by private carters	Commercial establishments must recycle and have it collected by private carters	N.A.	Commercial generators are required to recycle paper, metal, glass and plastic.
Recycling goals:					
Mandated goal	4250 tons/day by 2001	3,400 tons per day by 1999	4,250 tons/day by 2001	4,250 tons/day	4,250 tons/day
Non-mandated goal	No	No	No	No	No
Goals met	No	Yes	No	No	N.A.
Financial information:					
Recycling budget	76000000	95000000	100000000	103438905	65463866
Overall solid waste budget	$846,000,000	$1,000,000,000	$1,000,000,000	$1,040,600,000	$971,100,000
Recyclables revenue	$2,000,000	$3,000,000	$8,200,000	$5,960,778*	$7,767,797
Amount spent per resident on recycling	10.24	12.8	12.49	12.92	8.17
Recycling budget percentage	0.09	0.095	0.1	0.099	0.067

MATERIALS KEY: ABAT – automobile batteries; ALC – aluminum cans; APP – appliances; AUTO – automobiles; BVC – beverage cartons, drink boxes; CND – construction debris; ESRP – electronic scrap; FLP – fluorescent lamps; FOOD – food waste; FRN – furniture; GCON – glass containers; HDPE – HDPE plastic; HH – household hazardous waste; MG – magazines; MP – mixed paper; NP – newspaper; OCC – cardboard, corrugated containers; OP – office paper; PB – plastic bags; PET – PET plastic; TB – telephone books; TC – tin cans; TEX – textiles; WOOD – wood waste; TIRE – tires; OIL – oil, oil filters, grease; YARD – yard trimmings

Note: The data in this table reflect information reported in *Waste News* Municipal Recycling Surveys 2000 to 2004. The Department of Sanitation makes no warrant as to their accuracy with the exception of data on New York City.

***** New York's total tonnage collected and recyclables revenue incorporate scrap collected from the World Trade Center.

Table AVI-1
Summary of Municipal Recycling Survey—San Francisco
As Reported in *Waste News,* 2000–2004

Waste News publication Date	Feb-00	Feb-01	Feb-02	Feb-03	Feb-04
	SAN FRANCISCO	SAN FRANCISCO	SAN FRANCISCO	SAN FRANCISCO	SAN FRANCISCO
Population:	745,774	745,774	776,733	776,733	776,733
Recycling rate:	40.00%	42.00%	46.00%	48.00%	48.00%
Calculated for year ended:		Dec-99	Dec-00	Dec-01	Dec-01
Rate includes:					
Residential	x	x	x	x	x
Commercial	x	x	x	x	x
Other	—	City government, industrial	City government, industrial	City government, industrial	City government, industrial
Rates by category:					
Residential	—	N.A.	N.A.	38.00%	38.00%
Commercial	—	N.A.	N.A.	0.56	0.56
Materials included:					
(See key below)					
Paper	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP
Metal	ALC, TC, APP	ALC, TC	ALC, TC, APP	ALC, TC, APP, ESRP	ALC, TC, APP, ESRP
Plastic	PET, HDPE	PET, HDPE	PET, HDPE, PB	PET, HDPE, PB, BVC	PET, HDPE, PB, BVC
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	WOOD, CND, APP		TEX, WOOD, CND, FRN	TEX, WOOD, CND, FRN	TEX, WOOD, CND, FRN
Automotive	TIRE		TIRE	TIRE,OIL	TIRE,OIL
Hazardous			ESRP		
Organic	FOOD,YARD		FOOD,YARD	FOOD,YARD	FOOD,YARD
Other			BVC		
Total tonnage collected:	580,000	568,138	748,379	825,000	825,000
By city	0	0	0	0	0
By contracted haulers	580,000	568,138	748,379	N.A.	N.A.
Tonnage collected per material:					
Paper	172,000	144,317	163,680	85,000	85,000
Metal	21,000	18,638	8,688	31,000	31,000
Plastic	2,000	2,659	5,249	5,000	5,000
Glass	32,000	22,954	31,355	40,000	40,000
Yard trimmings	51,000	12,148	61,974	80,000	80,000
Other	302,000	367,422	477,433	584,000	584,000
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	Weekly	Weekly	Weekly	Weekly	Weekly
Number of households	325,000	333,000	333,000	300,000	300,000
Is program mandatory?	—	No	No	No	No
How are materials collected:	—	Commingled, single source	Commingled, source-separated	Commingled, source-separated	Commingled, source-separated
Program operated by:	—	Private haulers	Private haulers	Private haulers	Private haulers
Dropoff	Yes	Yes	Yes	Yes	Yes
Number of sites	25	24	20	20	20
Program operated by:	—	Private haulers	Private haulers	Private haulers	Private haulers
Multifamily dwelling	Yes	Yes	Yes	Yes	Yes
Program operated by:	—	Private haulers	Private haulers	Private haulers	Private haulers
Other	None	Bulky items, OIL	Bulky items, OIL	None	None
Commercial recycling program offered:	—	N.A.	Organic	Organic	Comingled, FOOD waste, bottles and cans
Recycling goals:					
Mandated goal	50% by 2000	50% diversion by 2000	50% diversion by 2000	50% diversion by 2000	50% diversion by 2000
Non-mandated goal	75% diversion by 2010	No	75% diversion by 2010	75% diversion by 2010	75% diversion by 2010
Goals met	No	N.A.	No	No	No
Financial information:					
Recycling budget	13000000	N.A.	N.A.	2231988	2231988
Overall solid waste budget	$105,000,000	$3,900,000	N.A.	N.A.	N.A.
Recyclables revenue	N/A	N.A.	N.A.	$10,603	$10,603
Amount spent per resident on recycling	17.43	N.A.	N.A.	2.87	2.87
Recycling budget percentage	0.124	N.A.	N.A.	N.A.	N.A.

MATERIALS KEY: ABAT – automobile batteries; ALC – aluminum cans; APP – appliances; AUTO – automobiles; BVC – beverage cartons, drink boxes; CND – construction debris; ESRP – electronic scrap; FLP – fluorescent lamps; FOOD – food waste; FRN – furniture; GCON – glass containers; HDPE – HDPE plastic; HH – household hazardous waste; MG – magazines; MP – mixed paper; NP – newspaper; OCC – cardboard, corrugated containers; OP – office paper; PB – plastic bags; PET – PET plastic; TB – telephone books; TC – tin cans; TEX – textiles; WOOD – wood waste; TIRE – tires; OIL – oil, oil filters, grease; YARD – yard trimmings

Note: The data in this table reflect information reported in *Waste News* Municipal Recycling Surveys 2000 to 2004. The Department of Sanitation makes no warrant as to their accuracy with the exception of data on New York City.

The City of San Francisco did not submit updated information for the year ending December 2002, so *Waste News* published the same data for San Francisco in 2003 and 2004.

Table AVI-1
Summary of Municipal Recycling Survey—Seattle
As Reported in *Waste News,* 2000–2004

Waste News publication Date	Feb-00	Feb-01	Feb-02	Feb-03	Feb-04
	SEATTLE	**SEATTLE**	**SEATTLE**	**SEATTLE**	**SEATTLE**
Population:	536,978	536,978	563,374	563,374	563,374
Recycling rate:	44.00%	52.00%	43.00%	37.90%	38.00%
Calculated for year ended:		Dec-99	Sep-01	Sep-02	Sep-03
Rate includes:					
Residential	x	x	x	x	x
Commercial	x	x	x	x	x
Other			x	x	x
Rates by category:					
Residential	—	57.00%	N.A.	48.50%	58.00%
Commercial	—	0.45	N.A.	0.367	N.A.
Materials included:					
(See key below)					
Paper	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP	NP, OCC, MG, TB, MP, OP
Metal	ALC, TC	ALC, TC	ALC, TC	ALC, TC	ALC, TC
Plastic	PET, HDPE, PB, BVC	PET, HDPE, PB, BVC	PET, HDPE, PB, BVC	PET, HDPE, PB, BVC	PET, HDPE, PB, BVC
Glass	GCON	GCON	GCON	GCON	GCON
Bulk	TEX, FOOD, APP, FRN	WOOD	TEX, WOOD, FOOD, APP, TIRE, OIL	TEX ,WOOD, FOOD, APP, TIRE,OIL	
Automotive	OIL				
Hazardous					
Organic	YARD	YARD	YARD	YARD	
Other	OTHER				
Total tonnage collected:	355,142	102,500	102,500	43,919	54,210
By city	0	0	0	0	0
By contracted haulers	355,142	102,500	102,500	43,919	54,210
Tonnage collected per material:					
Paper	230,842	46,800	46,800	N.A.	42,470
Metal	7,103	23,00	2,300	N.A.	1,035
Plastic	1,776	700	700	N.A.	1,205
Glass	14,205	13,000	13,000	N.A.	9,500
Yard trimmings	56,823	39,700	39,700	N.A.	0
Other	44,393	0	0		N.A.
Collection methods:					
Curbside	Yes	Yes	Yes	Yes	Yes
Frequency	variable	Biweekly	Bi-weekly	Bi-weekly	Bi-weekly
Number of households	250,000	180,000	146,000	146,000	N.A.
Is program mandatory?	—	No	No	No	No
How are materials collected:	—	Commingled	Source-separated	Source-separated	Source-separated
Program operated by:	—	Private Haulers	Private haulers	Private haulers	Private haulers
Dropoff	Yes	No	Yes	Yes	Yes
Number of sites	72	N.A.	2	2	2
Program operated by:	—	N.A.	City crews	City crews	City crews
Multifamily dwelling	Yes	Yes	Yes	Yes	Yes
Program operated by:	—	Private Haulers	Private haulers	Private haulers	Private haulers
Other	None	None	None	None	None
Commercial recycling program offered:		N.A.	N.A.	N.A.	N.A.
Recycling goals:					
Mandated goal	No	No	No	No	No
Non-mandated goal	60% by 2008	60% by 2008	60% by 2008	60% by 2008	60% by 2010
Goals met	No	N.A.	N.A.	No	No
Financial information:					
Recycling budget	12000000	6200000	6800000	N.A.	N.A.
Overall solid waste budget	$85,000,000	$88,500,000	$88,000,000	N.A.	N.A.
Recyclables revenue	N.A.	N.A.	N.A.	N.A.	N.A.
Amount spent per resident on recycling	22.35	11.55	12.07	N.A.	N.A.
Recycling budget percentage	0.141	0.07	0.077	N.A.	N.A.

MATERIALS KEY: ABAT – automobile batteries; ALC – aluminum cans; APP – appliances; AUTO – automobiles; BVC – beverage cartons, drink boxes; CND – construction debris; ESRP – electronic scrap; FLP – fluorescent lamps; FOOD – food waste; FRN – furniture; GCON – glass containers; HDPE – HDPE plastic; HH – household hazardous waste; MG – magazines; MP – mixed paper; NP – newspaper; OCC – cardboard, corrugated containers; OP – office paper; PB – plastic bags; PET – PET plastic; TB – telephone books; TC – tin cans; TEX – textiles; WOOD – wood waste; TIRE – tires; OIL – oil, oil filters, grease; YARD – yard trimmings

Note: The data in this table reflect information reported in *Waste News* Municipal Recycling Surveys 2000 to 2004. The Department of Sanitation makes no warrant as to their accuracy with the exception of data on New York City.

Table AVI-2
Annual Waste Stream and Diversion Tonnages Across Five U.S. Cities

	Chicago		Los Angeles		New York City		San Francisco		Seattle	
	Tons	Rate	Tons	Rate	Tons	Rate	Tons	Rate	Tons	Rate
Combined Waste Stream (Commercial, Residential, Institutional)	4,844,968 [1]		9,700,000 [1]		16,432,136 [12]		1,718,750 [1]		1,110,309 [1]	
Combined Diversion	2,146,321 [2]	44.3% [2]	5,331,105 [8]	55.0% [8]	8,430,774 [12]	51.31% [4]	825,000 [15]	48.0% [4]	477,433 [17]	43.0% [17]
Paper/MGP-Only Diversion	503,264 [3]	10.4% [4]	2,002,859 [9]	20.6% [4]	643,554 [12]	3.92% [4]	161,000 [16]	9.4% [4]	N/A	N/A
Organics Diversion	165,786 [2]	3.4% [4]	1,076,657 [8]	11.1% [4]	6,787 [12]	0.04% [4]	80,000 [15]	4.7% [4]	N/A	N/A
Other Diversion	1,477,271 [2]	30.5% [4]	2,251,590 [8]	23.2% [4]	7,780,433 [12]	47.35% [4]	584,000 [15]	34.0% [4]	N/A	N/A
Residential Waste Stream	3,117,713 [5]		593,477 [5]		3,454,181 [5]		N/A		251,479 [18]	
Residential Diversion	695,250 [6]	22.3% [6]	231,456 [10]	39.0% [10]	438,681 [13]	12.7% [13]	N/A	38.0% [15]	107,947 [21]	42.9% [4]
Paper/MGP-Only Diversion	560,251 [7]	18.0% [4]	184,994 [11]	31.2% [4]	433,205 [14]	12.5% [4]	N/A	N/A	74,024 [19]	29.4% [4]
Organics Diversion	134,999 [6]	4.3% [4]	6,495 [10]	1.1% [4]	5,476 [13]	0.2% [4]	N/A	N/A	33,923 [20]	13.5% [4]

See "Notes to Illustrations" for source information for this table.

This rate is for Fiscal Year 2003, during which time glass collection was temporarily suspended from NYC's recycling program. Since the reinstatement of glass collection in April 2004, the diversion rate has risen, attaining 17.2% as of May 2004. NYC's diversion rate before the temporary suspensions to the program averaged around 20%.

Table AVI-3
Summary of Waste Management Practices for Five U.S. Cities

	Chicago	Los Angeles
Service coverage		
City's solid-waste agency	Chicago Department of Streets and Sanitation	LA Bureau of Sanitation
Entity collecting waste		
Single, 1-4 family housing	Chicago Department of Streets and Sanitation	LA Bureau of Sanitation
Multifamily housing (5+ units)	Numerous private haulers	Numerous private haulers
Residential recycling service		
1-4 unit housing	All residences	All residences
Multifamily housing	N/A	Few residences. Pilot began 2004.
Residential waste-management funding structure	City taxes for single to four-unit housing; private fees for multiunit housing	Public program – property taxes supplemented by additional fees if resident sets out more than 60 gallons of refuse; Private program – private hauling arrangements
Is program voluntary or mandatory?	Voluntary	Voluntary
Number of separations	Two: commingled metal, glass, plastic, and paper in blue bag; refuse in black bag, but blue and black bags are collected in one truck	For public program – three: refuse, single-stream paper/MGP, and yard waste; For private program – none or two: paper/MGP and refuse
Separate organics collection?	No	Yes
Organics defined as	Organic residuals	Yard waste
How is contamination handled?	N/A since refuse and recycling are processed together in a mixed MRF	Recycling service suspension
Vehicle specifications	All material collected manually or semi-automated in single-bin truck	
Refuse		Automated, dual bin
Recycling		Automated, dual bin
Organics		Automated, dual bin
Number of vehicle operators per truck	Three (all waste collected in same truck)	One (same truck)
Refuse		
Recycling		
Organics		
MRFs and processing arrangements	Four mixed-materials recovery facilities	Six single-stream MRFs
Organics processing arrangements	Organics are land applied after passage through mixed-waste MRF	Outdoor facility co-composting yard waste, zoo waste, and biosolids in aerated stack piles
State container deposit law?	No	Yes
State recycled-content manufacturing law?	No	Yes

Table AVI-3
Summary of Waste Management Practices for Five U.S. Cities *(continued)*

New York City	San Francisco	Seattle
NYC Department of Sanitation	San Francisco Department of the Environment	Seattle Public Utilities
NYC Department of Sanitation	Norcal, Inc.	Waste Management of Seattle; US Disposal (Rabanco)
NYC Department of Sanitation	Norcal, Inc.	Waste Management of Seattle; US Disposal (Rabanco)
All residences All residences	All residences N/A	All residences 90% of units
City taxes	Residents pay monthly, quantity-based fees for refuse collection; recycling and organics collection is free. Residential program is supplemented by funds from commercial collection.	Residents pay monthly quantity-based fees for refuse collection; recycling and yard-waste collection is free
Mandatory	Voluntary	Voluntary
Three: commingled MGP, paper, and refuse	Three: refuse, single-stream paper/MGP, yard/food waste	Four: refuse; commingled paper, plastic, and metal; glass; and yard waste
Yes[1]	Yes	Yes
Leaves and yard waste	Yard and food waste	Yard waste
Ticketing and fines	Leaving bin at curb uncollected, with note	Suspension of service if a continual problem
Manual, single bin	Semi-automated, dual bin	Semi-automated, some dual bins; others with separate noncompacting box for glass
Manual, single or dual bin	Semi-automated, dual bin	Semi-automated, single bin
Manual, single bin	Semi-automated, single bin	Semi-automated, single bin
Two	One (same truck)	One
Two		One
Two	One	One
Multiple paper processors, one recycled paper mill, one MGP processor with three MRFs	Single-stream MRF, "Recycle Central"	Two single-stream MRFs, glass beneficiation facility[2] also used sometimes
Outdoor, windrow composting facilities	Ag-bag in vessel/outdoor windrow	Outdoor, static-pile composting facility
Yes	Yes	No
No	Yes	No

Notes: [1] NYC leaf and yard-waste composting program was suspended in 2002; due to resume Fall 2004.
[2] Refers to a glass-processing facility where recovered glass cullet is cleaned of contaminants.

Endnotes

Director's Note

1. See the Natural Resources Defense Council's *Wastewatch Summer 2001 Report: New York City's Failing Public Education Campaign for Recycling*, and the NYC Department of Sanitation's August 2001 response *New York City's Public Education Campaign For Recycling,* available from the Department upon request.

2. The United Nations defines a megacity as an urban region with more than 10 million inhabitants, including those living in the city proper and close-lying suburbs. New York City and Los Angeles are the only megacities in the United States. Others include: Tokyo, Sao Paulo, Mexico City, Bombay, Calcutta, Dhaka, Delhi, Shanghai, Buenos Aires, Jakarta, Osaka, Beijing, Rio de Janeiro, Karachi, and Manila. Source: United Nations, *World Urbanization Prospects: the 1999 Revision,* at <http://www.un.org/esa/population/publications/wup1999/wup99.htm>.

3. Neil Brenner, "State Territorial Restructuring and the Production of Spatial Scale," *Political Geography,* Vol. 16, No. 4, May 1997, pp. 273–306.

Introduction

1. Other City functions (mainly in construction, demolition, road building and fill operations) account for another 1.4 million tons annually, 95 percent of which is reused in road building and other infrastructural applications. This tonnage is matched by a little over 11 million tons per year from the private sector, the majority of which also comes from construction, demolition, and fill sources.

2. Throughout this report, "residential" will refer to residential *and* institutional sources serviced in New York City by DSNY. The latter include City agencies, schools, and public hospitals, as well as many nonprofit institutions and State/Federal government offices. The residential to institutional breakdown is roughly 88 percent to 12 percent, respectively, for the total DSNY-managed waste stream.

3. Christopher Williams, "Earth Day Celebrates Recycling, But Waste Companies See Red," *Dow Jones Newswires,* August 22, 2002.

Chapter 1: Recycling Economics

1. This is in contrast to the extensive planning of cities carried out in countries like the Netherlands, Denmark, and Sweden. See David Gordon, *Green Cities: Ecologically Sound Approaches to Urban Space,* Black Rose Books, Montreal, New York, 1990.

2. William K. Stevens, "When Trash Leaves the Curb: New Methods to Improve Recycling," *New York Times,* May 2, 1989, C1.

3. "Secondary materials" include municipal and commercial recyclables, as well as industrial scrap, which is frequently of even higher quality. In this report, "recycled materials" will refer to recyclables from residential and commercial MSW (including public institutions).

4. All prices discussed in this report are taken from *Recycling Manager, Official Board Markets,* or *Waste News.*

5. Recycling is mandatory for businesses under local law 87 of 1993. See DSNY's "Recycling: It's Not a Choice, It's the Law," available on the DSNY website: http://www.nyc.gov/sanitation/html/bw_comm/index.html.

6. Environmental Protection Agency, *Municipal Solid Waste in the United States, Facts and Figures,* 2000, EPA530-R-02-001.

7. Adam Smith published the *Wealth of Nations* in 1776. In it he argued that as long as there is free and fair competition among producers, social preferences are most efficiently and accurately met through the "invisible hand" of the market.

8. Christopher Williams, "Earth Day Celebrates Recycling, But Waste Companies See Red," *Dow Jones Newswires,* August 22, 2002.

9. U.S. Investment Research, April 28,1999, p. 1.

10. Peter Anderson, et al., "The Impact of Waste Industry Consolidation on Recycling," *MSW Management,* June 2001.

11. California Integrated Waste Management Board, *Markets Status Report: Secondary Material Export Markets,* http://www.ciwmb.ca.gov/Markets/StatusRpts/Exports.htm (accessed February 25, 2004).

12. See the Environmental Protection Agency's *The United States Experience with Economic Incentives for Protecting the Environment,* (EPA240-R-01-001) and the Northeast Recycling Council's *Recycling Economic Information Study,* June 2000, conducted by R.W. Beck, for but two examples of this massive body of literature.

13. William J. Clinton, 2000, "America Recycles Day Presidential Message," November 15, 1999, White House Proclamation.

14. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1998 Update,* September 1999 (EPA530-R-99-021).

15. These figures come from a 1996 survey conducted by the Container Recycling Institute. See http://container-recycling.org/publications/bevdesys/envirobenefits.html.

16. Daniel S. Wagner, *Rigid Plastic Packaging Containers: State Regulations,* International Sanitary Supply Association, Lincolnwood, IL, 2001.

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1. Jerry Powell, "What Have You Done for Me Lately," *Resource Recycling,* August 1997.

2. Telephone interview with Don Gibson, Recycling Coordinator, City of Tucson, July 12, 2002, conducted by Samantha MacBride.

3. City of Los Angeles, Dept. of Public Works, Bureau of Sanitation, Solid Resources Collection Division, *Best Practices Report,* 2000.

4. Staff, "Apples to Kumquats," *Waste News,* February 14, 2000.

5. These variables include: (1) demographics: population size, region, population density; (2) tonnage data: tons recycled/composted, the diversion rate (recycling plus composting); (3) cost data: recycling/composting cost per ton (total program costs), revenue per ton, and landfill tip fees; (4) funding sources: general fund, general waste-collection fees, material sales revenue, state grants, tipping fees/charges, other revenue sources, or special recycling collection fees; (5) important problems identified by recycling managers: financing/budget, securing participation, lack of markets, unfunded state mandate, obtaining information about best recycling practices, theft/scavenging of recyclables; (6) factors in annual budget discussions about continued funding for the recycling program: cost of recycling vs. disposal, recycling's political popularity, environmental benefits of recycling, state mandates/reduction goals, need to extend life of the landfill; (7) participation indicators: participation rate, whether program is mandatory or voluntary, curbside or drop-off only; (8) factors related to participation, diversion, costs: same day pickup, use of penalty, compost yard wastes, yard waste banned from SW landfill, recycling goal, free bins provided, block leaders for recycling, source separation requirement, speeches by city officials, variable-rate program (PAYT), recycling coordinator full time or half

time, tin and other materials recycled, multifamily generators, competitive bids required, materials sold to highest bidder, and technical assistance in marketing recyclables obtained from a state or regional organization.

6. David H. Folz, "Municipal Recycling: A Public Sector Environmental Success Story," *Public Administration Review,* July/August 1999, Vol. 59, No. 4.

7. Ibid.

8. Ibid.

9. Ibid.

10. Ibid.

11. Ibid.

12. NYC's recycling tonnage was approximately 665,000 tons per year pre-suspension. Doubling that, would save 665,000 x $0.02, or $13,000. To put this figure in perspective, DNSY's budget is roughly one billion dollars per year.

13. David H. Folz, "The Economics of Municipal Recycling: A Preliminary Analysis," *Public Administration Quarterly,* 1995, 19(3): 299–320.

14. Ibid.

15. Ibid.

16. Ibid.

17. David H. Folz, "Municipal Recycling: A Public Sector Environmental Success Story," *Public Administration Review,* July/August 1999, Vol. 59, No. 4.

18. Telephone interview with Don Gibson, Recycling Coordinator, City of Tucson, July 12, 2002, conducted by Samantha MacBride. Telephone interview with Mark Stout, San Francisco Dept. of the Environment, August 27, 2002.

19. David H. Folz, "Municipal Recycling: A Public Sector Environmental Success Story," *Public Administration Review,* July/August 1999, Vol. 59, No. 4.

20. Ibid.

21. Ibid.

22. Consumer Policy Institute/Consumers Union, *Taking out the Trash: A New Direction for New York City's Waste,* May 31, 2000, www.consumersunion.org/other/trash/trash1.htm.

23. U.S. Conference of Mayors, *Multifamily Recycling: A National Study,* EPA-530-R-01-018, November 2002, p. 1.

24. See U.S. Environmental Protection Agency, *Complex Recycling Issues,* EPA document 530-F-99-022, October 1999; Ronald McQuaid and Angus R. Murdoch, "Recycling Policy in Areas of Low Income and Multi-Storey Housing," Journal of Environmental Planning and Management, December 1996 39(4), p. 545; Recycling Council of Ontario, Assessment of Multi-Unit Recycling in Ontario, August 2000; and Knowlton Foote and Scott Foster, "Moving On Up," *Waste Age,* May 2002.

25. U.S. Conference of Mayors, *Multifamily Recycling: A National Study,* EPA-530-R-01-018, November 2002, p. 1.

26. Ibid., p.1.

27. Ibid., p. 13.

28. Ibid., p. 1.

29. Ibid., p. 1.

30. Ibid., p. 28.

31. Ibid., p. 1.

32. Ibid., p. 13.

33. Ibid., p. 2.

34. Ibid., p. 17.

35. Ibid., p. 2.

36. Ibid., p. 2.

37. Ibid., p. 9.

38. Ibid., p. 40.

39. Ibid., p. 40.

40. Ibid., p. 40.

41. Ibid., p. 48.

42. Ibid., p. 49.

43. Ibid., p. 49.

44. Ibid., p. 47.

45. Ibid., p. 39.

46. Ibid., p. 19.

47. Private collection includes contract, franchise, and subscription services.

48. U.S. Conference of Mayors, *Multifamily Recycling: A National Study,* EPA-530-R-01-018, November 2002, p. 19.

49. Ibid., p. 35.

50. Ibid., p. 9.

51. Ibid., p. 30.

52. Ibid., p. 45.

53. Ibid., p. 45.

54. Ibid., p. 45.

55. Ibid., p. 30.

56. Ibid., p. 13.

57. Institute for Local Self-Reliance/Environmental Protection Agency, *Cutting the Waste Stream in Half: Community Record Setters Show How,* EPA-530-R-99-013, June 1999, p. 2.

58. Ibid., p. 7.

59. Ibid., p. 7.

60. Ibid., p. 7.

61. Ibid., p. 116–117.

62. Ibid., pp. 8–10.

63. Ibid., pp. 8–10.

64. Ibid., p. 33.

65. Ibid., p. 9.

66. Ibid., p. 9–10.

67. Ibid., p. 9.

68. Ibid., p. 8.

Appendix III: Waste Prevention Policy and Planning: Clearing Up Confusion

1. For examples of this line of argument, see the Waste Prevention Coalition's *Why Waste the Future,* May 2002, available at http://www.wastesaver.com/WPCreport.pdf (accessed April 19, 2004); and Neil Seldman's *Paradigm Shift in NYC's Waste Management* at http://www.ilsr.org/recycling/NYC/NYCmain.html.

2. See, for example, Waste Prevention Coalition testimony to the City Council Sanitation Committee, March 20, 2002, referenced at www.geography.hunter.cuny.edu/~mclarke/resume.htm#Legislation&Testimony (accessed April 21, 2004).

3. See, for example: Alison Blackman Dunham, "Bloomberg, Budding Environmentalist?" *Gotham Gazette,* November 2001, available at http://www.gothamgazette.com/environment/nov.01.shtml accessed April 21, 2004. Blackman Dunham writes that "the cost of getting rid of the city's garbage can be reduced by handling as much as possible within city limits, rather than exporting it elsewhere.... Waste prevention of this sort costs only $27 per ton, while exporting it costs up to $100 per ton." The Department's research projects no such per ton cost in any of its publications.

4. New York City Department of Sanitation, *Comprehensive Solid Waste Management Plan,* August 1992. Volume 4.1, p. 22.

5. Ibid., p. 76.

6. Ibid.

7. Ibid.

8. Ibid.

9. Ibid.

10. The 10 waste prevention reports prepared by Science Applications International Corporation (SAIC) for the NYC Department of Sanitation/Bureau of Waste Prevention, Reuse & Recycling are at the following location on the DSNY website: http://www.nyc.gov/html/dos/html/recywprpts.html#.

11. SAIC/Tellus Institute for the New York City Department of Sanitation, *Measuring Waste Prevention in New York City,* Spring 2000, p. 116.

12. Ibid., p. 116; Tables 2-4, p. 36; 2-6, p. 44; 2-10, p. 54; 2-11, p. 61; 2-13, p. 66.

13. Ibid., p. 11.

14. Marjorie Clarke, "New York City After Fresh Kills: Latest Developments in the Planning Process (the Saga Continues)", presented and published in the *Proceedings of the Air and Waste Management Association's 94th Annual Meeting and Exhibition,* Orlando, FL, June 24–28, 2001, referenced at www.geography.hunter.cuny.edu/~mclarke/resume.htm#MajorPapers&Pubs (accessed April 21, 2004).

15. Waste Prevention Coalition, *Why Waste the Future,* May 2002, available at http://www.wastesaver.com/WPCreport.pdf (accessed April 19, 2004).

16. Neil Seldman's *Paradigm Shift in NYC's Waste Management* at http://www.ilsr.org/recycling/NYC/NYCmain.html (accessed April 21, 2004).

17. New York City Waste Prevention Coalition, *Waste Prevention in New York City: The Bare Facts,* available at www.geography.hunter.cuny.edu/~mclarke/wpcoalitionbrochure.htm (accessed April 21, 2004).

18. Waste Prevention Committee, Manhattan Citizens' Solid Waste Advisory Board, *Comments and Questions Regarding the 2000 NYC Solid Waste Management Plan and DEIS,* June 16, 2000, available upon request through www.geography.hunter.cuny.edu/~mclarke/mcswab.htm.

19. SAIC/Tellus Institute, *Measuring Waste Prevention in New York City,* Spring 2000, Table 3-1, p. 116.

20. This is the sum of DSNY implementation costs for 2002 only, for four of the eleven programs that were still being funded that year. These costs were, for NY Waste Match, $122,000, as reported on Table 2-4, p. 36; for NYC Stuff Exchange, $332,931, as reported in Table 2-6, p. 42; NYC WasteLe$$, $1,680,000, as reported in Table 2-10, p. 54, and Materials for the Arts, $180,000, Table 2-13, p. 66;all in SAIC/Tellus Institute, *Measuring Waste Prevention in New York City,* Spring 2000.

21. Marjorie Clark, "New York City After Fresh Kills: Latest Developments in the Planning Process (the Saga Continues)", presented and published in the *Proceedings of the Air and Waste Management Association's 94th Annual Meeting and Exhibition,* Orlando, FL, June 24–28, 2001, referenced at www.geography.hunter.cuny.edu/~mclarke/resume.htm#MajorPapers&Pubs (accessed April 21, 2004).

22. Statement of Marjorie J. Clarke, Ph.D., Lehmann College, "Statement to Sanitation Committee, New York City Council," February 7, 2002 at www.geography.hunter.cuny.edu/~mclarke/testimony.htm.

23. Waste Prevention Coalition testimony to the City Council Sanitation Committee, March 20, 2002, referenced at www.geography.hunter.cuny.edu/~mclarke/resume.htm#Legislation&Testimony, (accessed April 21, 2004).

24. Citywide Recycling Advisory Board, "Rational Solid Waste Management in New York," February 2002, www.geography.hunter.cuny.edu/~mclarke/CRABFeb2002positions-a.htm.

25. Alison Blackman Dunham, "Bloomberg,

Budding Environmentalist?", *Gotham Gazette,* November 2001, available at www.gothamgazette.com/environment/nov.01.shtml, (accessed April 21, 2004).

26. Waste Prevention Coalition. *Why Waste the Future,* May 2002, available at http://www.wastesaver.com/WPCreport.pdf (accessed April 19, 2004).

27. Ibid.

28. Ibid.

29. Waste Prevention Committee, Manhattan Citizens' Solid Waste Advisory Board, *Comments and Questions Regarding the 2000 NYC Solid Waste Management Plan and DEIS,* June 16, 2000, available upon request through www.geography.hunter.cuny.edu/~mclarke/mcswab.htm.

30. In 2002, the Mayor and City Council funded a community-based waste-prevention outreach and education program—the Waste Prevention Community Coordinator Program. This program, overseen by BWPRR, was initially funded for $6.3 million and was to run for three years. Due to the citywide fiscal crisis, program funding was scaled back to $1 million and the program ran for only one year (Summer 2002 to early Fall 2003).

INFORM Inc. (INFORM) and the Council on the Environment of New York City (CENYC) were contracted to complete projects through this program. To complete their portion of the work, INFORM subcontracted with eight local community organizations, chosen through a competitive proposal process. Collectively, these organizations held 16 educational events (such as lectures, workshops, and free classes) and 27 one- and two-day drop-off events for electronics, used clothing, books, home furnishings, building materials, and yard waste. INFORM estimates that through these events at least 381 tons of material were diverted from the City's waste stream.

CENYC worked with existing and newly hired staff to conduct waste-prevention education and technical-assistance programs at different NYC Housing Authority locations and NYC Department of Education schools. Through nine programs, approximately 375 tons of materials were diverted from the waste stream.

31. Willard Mies, *Pulp & Paper 1999 North American Factbook,* 1999, p. 16. Calculations were based on "consumption" (production plus net imports), a measure of domestic use.

32. Daniel C. Walsh, "Urban Residential Refuse Composition and Generation Rates for the 20th Century," *Environmental Science and Technology,* Volume 36, No. 22, 2002.

Appendix IV: Public Education About Recycling

1. Natural Resources Defense Council, *New York City's Failing Public Education Campaign for Recycling* at www.nrdc.org/cities/recycling/nycsurvey/survey.asp (accessed April 29, 2004).

2. Citywide Recycling Advisory Board, *Rational Solid Waste Management in New York,* February 2002, www.geography.hunter.cuny.edu/~mclarke/CRABFeb2002positions-a.htm (accessed May 17, 2004).

3. The "Expanded Recycling Program" added mixed paper, as well as household metal, bulk metal, and beverage cartons to the list of materials designated for recycling.

4. Telephone interview with Gloria Chan, San Francisco Department of the Environment, March 12, 2003.

5. Lisa Skumatz and John Green, *Evaluating the Impacts of Recycling/Diversion Education Programs–Effective Methods and Optimizing Expenditures,* report for the State of Iowa Department of Natural Resources, May 2002. Available for purchase at www.serainc.com (accessed April 29, 2004).

6. Ibid.

7. Ibid.

8. Institute for Local Self-Reliance/Environmental Protection Agency, *Cutting the Waste Stream in Half: Community Record Setters Show How,* EPA-530-R-99-013, June 1999, p. 25.

9. Ibid.

10. Interview with Gloria Chan, Public Information Officer, San Francisco Dept. of the Environment, March 12, 2003.

11. Lisa Skumatz and John Green, *Evaluating the Impacts of Recycling/Diversion Education Programs–Effective Methods and Optimizing Expenditures,* report for the State of Iowa Department of Natural Resources, May 2002. Available for purchase at www.serainc.com (accessed April 29, 2004).

12. Ibid.

13. Institute for Local Self-Reliance/Environmental Protection Agency, *Cutting the Waste Stream in Half: Community Record Setters Show How,* EPA-530-R-99-013, June 1999, p. 26.

Notes to Illustrations

Chapter 1

Notes to Chart 1-1: Recycled Paper Prices

Official Board Markets (OBM) is published by Advanstar Communications, and can be accessed at www.packaging-online.com. OBM publishes Transacted Paper Stock Prices for the following regions: Chicago, New England, Buffalo, New York, Southeast, Southwest, Los Angeles, San Francisco, and Pacific Northwest. Historical data is available starting in January 1987. Commodities tracked are Mixed Paper, Boxboard Cuttings, ONP (old newspaper) #6, ONP (old newspaper) #8, OCC (old corrugated cardboard), Sorted Office Paper, and Sorted White Ledger (white office paper). Because DSNY paper contracts calculate per-ton costs and revenues using price categories for Mixed Paper, Newspaper #6, Newspaper #8, Corrugated, and White Office Paper, only these prices are shown in Chart 1-1. During certain periods, prices for certain commodities were not tracked by OBM. In these cases, trend lines are not shown for these periods.

Prices in Chart 1 are the average of high and low prices for each commodity reported per short ton. Grades and preparation requirements are as defined in current Paper Stock Industries' Standards and Practices Circular (PS-02); grade numbers appear in parentheses. These are board and paper-mill purchase prices, baled, F.O.B. (freight on board) seller's dock, exclusive of delivery charges, and of premium, spot, or distress lots, and of all subsequent charges for packing, handling, less-than-full-load freight, destination considerations, or other special charges. The prices listed are for reference only, and do not connote any commitment by any supplier to sell, nor by any purchaser to buy, any material at the price listed or at any price predicated upon the price listed. For further information on pricing, contact OBM at 888-527-7008.

Notes to Chart 1-2: Recycled Metal Prices;
Chart 1-3: Recycled HDPE and PET Plastic Prices;
and Chart 1-4: Recycled Glass Prices

Recycling Manager is published by American Metal Market LLC, and can be accessed at www.amm.com**.** *Recycling Manager* tracks materials prices for 15 major U.S. regions: Atlanta, Boston, Chicago, Cleveland, Dallas/Houston, Denver, Detroit, Los Angeles, Miami, Minneapolis, New York, Philadelphia, San Francisco, Seattle/Portland, and Washington, D.C. Historical data is available starting May 1991. Commodities tracked are: Used Steel Cans, No. 2 Ferrous Bundles, Municipal Shredded Ferrous, Shredded Auto Scrap, Aluminum UBCs (used beverage containers), Auto Batteries, Baled Clear PET, Baled Green PET, Baled Natural HDPE, Baled Mixed HDPE, Baled Mixed PET, Baled Mixed HDPE & PET, Flaked Clear PET, Flaked Green PET, Flaked Natural HDPE, Clear Glass, Green Glass, and Brown Glass. Because DSNY metal, glass, and plastics contracts calculate per ton costs and revenues using price categories for Used Steel Cans, Aluminum UBCs, Baled Natural HDPE, Baled Mixed HDPE, Baled Mixed PET, Clear Glass, Green Glass, and Brown Glass, only these prices are shown in Charts 1-2, 1-3, and 1-4.

Prices in Chart 1-1 are the average of high and low prices for each commodity reported in *Recycling Manager*. Prices for Aluminum, PET, and HDPE are published in cents per pound and have been translated to dollars per short ton for Charts 1-2, 1-3, and 1-4. Other prices are dollars per short ton. Prices are based on representative volumes delivered to consumers in each market area unless otherwise stated. Prices are the opinions of editors based on contacts with originators, scrap dealers, brokers, and consumers. Prices generally represent truckload quantities of baled, high-quality, well-separated materials meeting the specifications of local market buyers. For further information on pricing, contact *Recycling Manager* at (610) 205-1068.

Notes to Chart 1-5: Comparison of Paper Prices in New York Region to West Coast Regions

Prices shown are averages of monthly prices for Mixed Paper, Newspaper #6, Newspaper #8, Corrugated Cardboard, and

White Office Paper reported in *Official Board Markets* (OBM). Regions are as reported in this source as well. Data cover the period 1987 to 2002 only, because DSNY did not have access to pricing data from 2002 onward for regions other than New York. For further details on OBM pricing, see notes to Chart 1-1 above.

Notes to Chart 1-6: Comparison of MGP Prices in New York Region to West Coast Regions

Prices shown reflect monthly prices for Steel Cans, Aluminum Cans, Natural HDPE, Mixed HDPE, Mixed PET, Clear Glass, Green Glass, and Brown Glass averaged together from data reported in *Recycling Manager.* Regions are as reported in this source as well. Data cover the period 1991 to 2000 only, because DSNY did not have access to pricing data from 2001 onward for regions other than New York. For further details on *Recycling Manager* pricing, see notes to Charts 1-2 to 1-4 above.

Chapter 2

Notes to Chart 2-1: Paper and MGP Diversion Rate Over Time

Diversion rates shown represent the total tonnage of curbside and containerized recycling collected in each Fiscal Year, divided by the sum of curbside and containerized recycling and refuse. Rates do *not* reflect recycling of construction and demolition debris, asphalt, millings, clean fill, auto bodies, or tires. They also do not reflect a small tonnage of composting each year.

Chapter 3

Notes to Chart 3-2: Recycled Paper Prices, NYC vs. Northwest

Prices shown are average of Mixed Paper, Newspaper #6, Newspaper #8, Corrugated Cardboard, and White Office Paper published in *Official Board Markets*. Regions are as reported in this source as well. Data cover the period 1995 to 2002 only, because DSNY did not have access to pricing data from before or after this period for the Pacific Northwest. For further details on OBM pricing, see notes to Chart 1-1 above.

Appendix VI

Notes to Table AVI-2: Annual Waste Stream and Diversion Tonnages Across Five U.S. Cities

1. This figure was derived by dividing the combined diversion tonnage by the combined diversion rate, according to the following formula:

$$\text{if the combined diversion rate} = \frac{\text{combined recycling tonnage}}{\text{combined waste (recycling + refuse) tonnage}}$$

then…

$$\frac{\text{combined recycling tonnage}}{\text{combined diversion rate}} = \text{combined waste tonnage}$$

2. As reported in the *Waste News* Municipal Waste Survey, 2003. Reflects combined residential and commercial data for Chicago, year ending June 2002.

3. This figure was derived by adding paper, metal, glass, and plastic diversion in the *Waste News* Municipal Waste Survey, 2003. Reflects combined residential and commercial data for Chicago, year ending June 2002.

4. This figure was derived by dividing the tonnage diverted by the combined waste tonnage.

5. This figure was derived by dividing the residential diversion tonnage by the residential diversion rate, according to the following formula:

$$\text{if the residential diversion rate} = \frac{\text{residential recycling tonnage}}{\text{residential waste (recycling + refuse) tonnage}}$$

then…

$$\frac{\text{residential recycling tonnage}}{\text{residential diversion rate}} = \text{residential waste tonnage}$$

6. As reported in the *Waste News* Municipal Waste Survey, 2004. Reflects combined residential data for Chicago, year ending June 2003.

7. This figure was derived by adding paper, metal, glass, and plastic diversion in the *Waste News* Municipal Waste Survey, 2004. Reflects combined residential data for Chicago, year ending June 2003.

8. As reported in the *Waste News* Municipal Waste Survey, 2002. Reflects combined residential and commercial data for Los Angeles for year ending June 2001.

9. This figure was derived by adding paper, metal, glass, and plastic diversion in the *Waste News* Municipal Waste Survey, 2002. Reflects combined residential and commercial data for Los Angeles for year ending June 2001.

10. As reported in the *Waste News* Municipal Waste Survey, 2004. Reflects residential data for Los Angeles for year ending June 2003.

11. This figure was derived by adding paper, metal, glass, and plastic diversion in the *Waste News* Municipal Waste Survey, 2004. Reflects residential data for Los Angeles for year ending June 2003.

12. As reported to the New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials (see Appendix V). Reflects residential, commercial, and sewage-sludge data from calendar year 2002. Note that the diversion tonnages do not reflect commercial paper, MGP, or other diversion handled by out-of-city facilities. The commercial recycling tonnages are therefore understated.

13. As reported in the *Waste News* Municipal Waste Survey, 2004. Reflects residential data for New York City for year ending June 2003.

14. This figure was derived by adding paper, metal, glass, and plastic diversion in the *Waste News* Municipal Waste Survey, 2004. Reflects residential data for New York City for year ending June 2003.

15. As reported in the *Waste News* Municipal Waste Survey, 2004. Reflects combined commercial, industrial, and residential data for San Francisco for year ending December 2001.

16. This figure was derived by adding paper, metal, glass, and plastic diversion in the *Waste News* Municipal Waste Survey, 2004. Reflects residential data for Los Angeles for year ending December 2001.

17. As reported in *Solid Waste At A Glance*, 1999, at http://www.cityofseattle.net/util/solidwaste/reports.htm. Reflects combined commercial and residential data for Seattle for year ending December 1999.

18. As reported in *Garbage Report, December 2003*, at http://www.cityofseattle.net/util/solidwaste/reports.htm. Reflects residential data for Seattle for year ending December 2003.

19. As reported in *Curb/Alley Recycling Report, December 2003*, and *Apartment Recycling Report, December 2003*, at http://www.cityofseattle.net/util/solidwaste/reports.htm. Reflects residential data for Seattle for year ending December 2003.

20. As reported in *Yard Waste Report, December 2003*, at http://www.cityofseattle.net/util/solidwaste/reports.htm. Reflects residential data for Seattle for year ending December 2003.

21. This figure was derived by adding paper, metal, glass, plastic, and yard-waste diversion reported as per notes 21 and 22 above.