

How Do We Measure Them? Lessons from Long Island on Computing Recycling Rates

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U.S. EPA 1997

Glenn
NYS DEC 1997

RECYCLING rates are often used as measures of the effectiveness of waste management programs or policies. Particular rates have also been set as mandates for local programs, as goals as part of general public policy, and as regulatory tools in permit processes. Therefore, the computation of a recycling rate for a particular program, region, or waste stream is often of public interest or may have legal implications.

It is not clear that the rates reported to the public are the most appropriate. Municipalities may not report all the recycling credits they could claim. We also believe that what is reported to the public as recycling is not what the public perceives as recycling. This paper examines both concepts in the context of data collected from Long Island for 1994.

Background

Recycling rates result from the management of municipal solid waste (MSW). MSW is composed of the non-hazardous residues produced at residences, businesses, and institutions. Certain materials are usually excluded from the definition of MSW, although they are solid wastes or are produced at residences, businesses, or institutions. Excluded materials include liquid septic wastes, solid residues and

sludge from sewage treatment, automobiles, and construction and demolition debris (C&D). Certain other wastes that do not fit the original definition of MSW are, however, usually included in practical determinations of MSW. These include small amounts of residentially generated hazardous wastes such as cleansers and household insecticides, and office and cafeteria wastes from industrial sites. Unfortunately, there is not complete agreement on these definitions. For example, the U.S. Environmental Protection Agency recently determined the nation's waste stream to be 210 million tons per year, but *BioCycle's* annual survey computed a waste stream of nearly double that at 390 million tons for 1999 (most of the difference was due to *BioCycle's* inclusion of C&D in its assessment).

A recycling rate can be understood to be the percentage expression of the result of dividing the amount of recycled wastes by the total amount of MSW produced during a period of time, usually in a particular region, industrial sector, or for a particular MSW component. But it is difficult to determine exactly the amount recycled (the numerator) and the appropriate total waste stream size (the denominator). Thus, ranges of recycling rates should result in any situation where MSW and recyclables have been measured, because of uncertainties in these components of the calculation. For example, in New York State, the legislature computed the state's recycling rate for 1997 as 23.6 percent; the Governor's agency, the Department of Environmental Conservation, computed the rate to be 41.9 percent.

Recycling rates can be calculated directly from exact measurements made during disposal and recovery processes. Alternatively, if the entire waste stream size can be known or determined, and the amount of MSW disposed can be measured, it can be assumed that the amount recycled (or, accounted by recycling and waste reduction* together) constitutes the remainder of the waste stream or waste stream fraction. It is also possible that neither method can be applied with confidence or is necessarily appropriate.

Because recycling rates are of public interest and may have legal implications for local governments, usually it is in these governments' interests to maximize the determined rate (see the difference between the legislative or oversight branch's calculation, and the executive or administrative branch's estimate, above). Additionally, it may be in these governments' interests to artificially minimize recycling or maximize overall waste generation rates for initial years in order to overstate the effectiveness of their programs' progress. In doing so, however, the information intended to be conveyed may become clouded or distorted for the general public.

Franklin Associates
Office of Technology Assessment

U.S. EPA 1998

Goldstein

Rathje

Golden and Matthews
New York State 1998

*The term "waste reduction" (synonymously, "waste avoidance") refers to solid waste or potential solid waste that does not enter the waste management process. Wastes can be avoided by never being created in the first place (as when e-mail is used in place of paper interoffice memos), by reducing the amount of wastes generated (as when a manufacturer reduces the amount of plastic in the production of soda bottles, resulting in lighter bottles and so fewer wastes when they are discarded or recycled), by delaying their entry into the waste stream (as when tires last longer, and are, thus, discarded less frequently), by reusing a product (as when bottles are rinsed and refilled, thus avoiding the entry of the bottle into the waste stream), or by being treated outside of formal waste management systems (as when yard wastes are disposed through backyard composting).

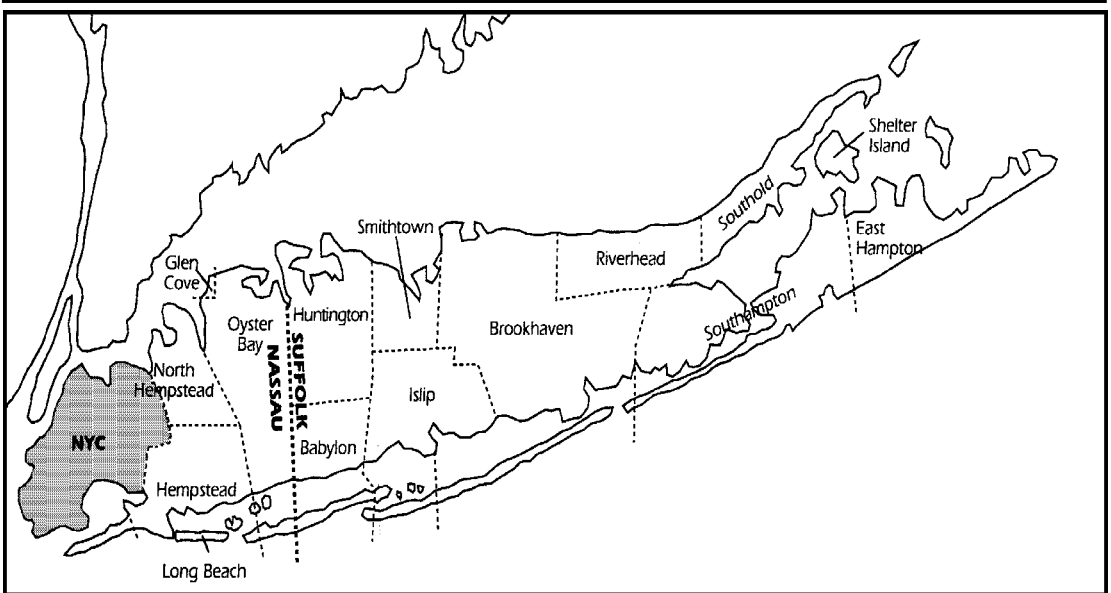
Tonjes and Swanson 1994

We have analyzed recycling and waste reduction on Long Island for over a decade. Here we focus on the calendar year 1994, a year for which we have a particularly robust data set. The lessons learned in 1994, despite their age, have general applicability even in this new century. Despite the fact that it seems advantageous for local governments to maximize reported rates, we found that it was possible to find uncounted recyclables (and uncounted disposed MSW) on Long Island in 1994. Thus, it was possible to construct alternative recycling rate derivations from those generated by local governments. This paper presents the several determinations of recycling rates that resulted and discusses some of the issues that weigh on the determination of “true” recycling rates.

Description of Long Island

Long Island, part of New York State, extends 125 miles east-northeast into the Atlantic Ocean from Manhattan, and is up to 25 miles wide. Politically, it is divided into four counties: Kings (Brooklyn), Queens, Nassau, and Suffolk Counties. Kings and Queens Counties are part of Greater New York City; this results in “Long Island proper” usually being considered as the eastern two-thirds of the physical island—just Nassau and Suffolk Counties. (See Figure 1.)

FIGURE 1
Long Island Municipalities



The population of Nassau and Suffolk Counties in 1994 was 2.6 million, and was divided nearly evenly between the counties. Population density tends to decrease with distance from New York City. Although Long Island as a whole is extremely wealthy, household income is noticeably higher in the “North Shore” towns, and in Nassau County (which is closer to New York City than Suffolk County). (See Table 1.) Each county has a County Executive and a unicameral legislature. However, subdivisions of the counties, both “Towns” and “Cities,” have retained historical rights and privileges. Waste management, for example, is almost exclusively the domain of the three towns and two cities of Nassau County and the ten towns of Suffolk County. This has been codified in New York State’s waste management regulations.

Long Island Lighting Company

Newsday
Koppleman

NYSDEC 1997

TABLE 1
Long Island Municipal Statistics, 1994

	<i>Population</i>	<i>Area (sq. mi.)</i>	<i>Population Density</i>	<i>Household Income</i>
Nassau County	1,283,985	276	4,652	
Glen Cove	24,074	7	3,439	\$61,466
Hempstead	724,179	108	6,705	\$61,358
Long Beach	33,987	4	8,497	\$65,609
North Hempstead	211,148	54	3,910	\$87,803
Oyster Bay	290,597	103	2,821	\$74,360
Suffolk County	1,329,812	901	1,476	
Babylon	203,199	50	4,064	\$50,762
Brookhaven	415,471	261	1,592	\$52,353
East Hampton	16,305	71	230	\$52,399
Huntington	189,397	94	2,015	\$71,264
Islip	300,363	103	2,916	\$54,920
Riverhead	23,457	68	345	\$36,362
Shelter Island	2,270	11	206	\$53,653
Smithtown	113,187	54	2,096	\$66,083
Southampton	46,068	140	329	\$53,710
Southold	20,095	49	410	\$43,718
Long Island Total	2,613,797	1,177	2,221	

Source: Long Island Lighting Company; Newsday; Koppleman

Ground water from underground aquifers is an exceedingly important part of the environmental description of Long Island. This resource has been degraded in Kings and Queens Counties, so that drinking water is now supplied to those counties through the New York City reservoir system found in upstate New York. Nassau and Suffolk Counties still rely on the aquifers for all drinking water (making them “Sole Source Aquifers” under the Federal Water Pollution Control Act). Protective measures taken on behalf of the aquifers include a state law, the “Long Island Landfill Law,” that banned the landfilling of MSW on Long Island after 1990.

Koppleman

New York State 1983

Long Island Waste Management Systems

The fifteen different governments listed in Table 1 have not tended to adopt the same means of managing MSW. The different systems can be grouped in a variety of ways. For example, in 1994 the eleven westernmost municipalities all provided residential collection services (curbside systems); several of these municipalities also provided a degree of commercial waste collection, although no municipality claimed responsibility for all wastes generated within its bounds; the four easternmost towns, which are rural and have smaller populations, used drop-off systems at transfer stations located at the old landfill sites (although individuals and businesses could privately contract for waste management collection services). Five municipalities had their own waste-to-energy (WTE) incinerators, and two others shipped collected MSW to two of these plants through formal agreements; seven municipalities contracted with private firms to manage their collected MSW through out-of-municipality (and presumably, off-Long Island) facilities; and one, despite the Landfill Law, still relied on landfilling as its primary MSW disposal means. Thirteen of the municipalities collected waste management fees through property tax collection systems; the other two used pay-as-you-throw systems—Pay-per-Bag, volume-based pricing systems, where MSW could only be delivered to the facilities in specially purchased, specially priced bags. (See Table 2.) All, however, in accord with

Tonjes and Swanson, *Doing the...*

TABLE 2
Municipal Waste Management Systems, 1994

	<i>WTE Plant</i>	<i>WTE Access</i>	<i>Landfill</i>	<i>Off-LI Disposal</i>	<i>Residential Collection</i>	<i>Business Collection</i>	<i>Drop-off</i>	<i>PAYT</i>
Nassau County								
Glen Cove				X	X	X		
Hempstead	X				X	X		
Long Beach	X				X	X		
North Hempstead				X	X			
Oyster Bay				X	X			
Suffolk County								
Babylon	X				X			
Brookhaven		X			X			
East Hampton				X			X	
Huntington	X				X			
Islip	X				X			
Riverhead				X	X			
Shelter Island				X			X	X
Smithtown		X			X			
Southampton			X				X	
Southold				X			X	X

WTE= "Waste-To-Energy" Incinerator

PAYT = "Pay As You Throw"

Off-LI Disposal may include MSW disposed at the WTE incinerators on LI through "spot market" arrangements.

New York State Law, had enacted ordinances making the recycling of certain materials mandatory, particularly newspaper, corrugated cardboard, aluminum and steel cans, and plastic (PET and HDPE—#1 and #2) and glass bottles, by all residents by September 1992.

New York State 1998

Self-Reported Recycling Rates

New York State, as with most other recycling statistics gatherers, relies on data collected by its constituent municipalities to generate annual recycling reports. We similarly collected local Long Island data for 1994.

Municipal data showed Long Island recycled 31 percent of its waste stream in 1994. The municipalities reported a recycling tonnage of exactly 816,262 tons and a disposal tonnage of 2,610,591 tons. We classified the reported recyclables into three categories: household recyclables (paper products such as newspapers (ONP), corrugated cardboard (OCC), junk mail, and containers such as metal cans, plastics, and glass bottles, collected from residences or through drop-off programs); yard wastes (including unclassified wood); and "other" (which included any reported recycling through non-municipal systems in the private sector). Only 28 percent of all municipally claimed recyclables were household recyclables; and nearly 40 percent of the claimed municipal recycling credits came from yard wastes. (See Table 3.)

Tonjes and Swanson, *Comparing...*

TABLE 3
Municipally Reported Waste Stream and Recycling Data, 1994

	<i>Waste Stream Tonnage</i>	<i>Recycling Tonnage</i>	<i>Recycling Rate</i>	<i>Household Recyclables</i>	<i>Yard Waste</i>	<i>Other</i>
Nassau County	1,382,047	508,043	37%	21%	36%	39%
Glen Cove*	22,000	3,250	~15%	~75%	~15%	~10%
Hempstead	839,659	346,418	41%	17%	46%	37%
Long Beach	28,126	3,655	13%	94%	0%	6%
North Hempstead	223,527	76,442	34%	26%	30%	44%
Oyster Bay	268,735	78,278	29%	33%	11%	56%
Suffolk County	1,228,544	308,189	25%	39%	42%	19%
Babylon	151,102	45,658	30%	28%	56%	16%
Brookhaven	344,384	75,500	22%	43%	55%	3%
East Hampton	26,022	6,178	24%	48%	41%	11%
Huntington	212,239	56,001	26%	41%	47%	12%
Islip*	280,000	90,000	~30%	~25%	~35%	~40%
Riverhead*	29,000	3,000	~10%	~65%	~25%	~10%
Shelter Island*	2,100	1,000	~45%	~40%	~50%	~10%
Smithtown	104,022	13,281	13%	89%	0%	11%
Southampton	54,675	9,571	18%	85%	0%	15%
Southold*	25,000	8,000	~30%	~40%	~30%	~30%
Long Island Total	2,610,591	816,232	31%	28%	39%	33%
<i>Adjusted Totals</i>	3,250,000	816,232	25%			

*Estimated data based on 1993 data.

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This depiction of Long Island recycling did not seem complete. For one, earlier work of ours had found that Long Island's waste stream had a size closer to 3.25 million tons. The discrepancy between this estimate and the municipal reports stemmed from municipalities not counting various wastes that were not processed through the municipal systems. In some towns, independent villages can make their own waste management arrangements. Such villages constitute 60 percent of the population of the town of North Hempstead, for instance. In other towns, greater-than-market-rate disposal facility tipping fees resulted in much of the commercial waste stream avoiding town facilities in 1994—the case for Brookhaven, Huntington, and Islip.

Using the larger 3.25 million tons waste stream as the denominator to calculate the recycling rate resulted in a decreased recycling rate of 25 percent for Long Island. However, there were good reasons to assume that all Long Island recycling had not been accounted for, and that the actual recycling tonnage could be considered to be more than the municipally reported total of 816,232 tons.

Adding Commercial Recycling Tonnages

The direct compilation of data for private-sector recycling efforts proved to be impossible for Long Island. There were several contributing factors:

- 1) poor data records as kept by state regulators
- 2) general data problems with volumes versus weights measures
- 3) overall secretive business practices in an industry long noted for ties to, and control by, organized crime.

Tonjes and Swanson, *Plumbing...*

Reuter

It did prove possible to create surrogate data sources for reasonable estimations of private recycling efforts.

In 1994, four of the fifteen Long Island municipalities did not provide any municipal collection services (although these could have been contracted for). For these towns, it proved to be impossible to differentiate between residentially and commercially generated MSW. The other eleven municipalities all provided curbside collection. Eight restricted these services to single- and two-family residences. Therefore, except where businesses were provided with a degree of collection services, all the recycling tonnages from curbside collection tallied above are assumed to be residentially generated.

Three municipalities did make efforts to specially quantify additional recycling services provided by private companies in the commercial waste stream. These were the towns of Babylon, Hempstead, and Oyster Bay. They required private companies to report these tonnages as a part of annual licensing procedures (carter licensing is not standardized throughout Long Island, and so these were the only towns that required these data). The town of Hempstead was the only one of these three municipalities to provide a degree of waste management services to businesses through its municipal program (including recyclables collection). Hempstead is willing to collect three garbage cans of MSW from all commercial establishments, twice a week, and an unlimited amount of recyclables once a week. However, those establishments generating large quantities of recyclables may have preferred to contract for additional, stand-alone container service rather than storing the recyclables for a week and then setting them all out curbside on Tuesday evenings for Wednesday pickup. The reports from these three towns, at first glance, appeared to be quite disparate. (See Table 4.)

TABLE 4
Private Sector Recycling Data* from Three Municipalities

<i>Municipality Year</i>	<i>Babylon 1993</i>	<i>Hempstead 1993</i>	<i>Hempstead 1994</i>	<i>Oyster Bay 1993</i>	<i>Oyster Bay 1994</i>
Paper	19,235	8,633	8,012	31,785	31,854
ONP				16,872	15,026
OCC	12,571	5,762	6,438	14,571	15,438
Office	3,841	2,871	1,574		
Mixed				342	1,480
Other	2,823				
Containers	98			28	15
White Goods-					
Mixed Metal	3,748	3,672	8,536	6,771	8,149
Yard Wastes				154	39
Other Wood		7,647	8,572		
Waste Oil		161	382	17	75
Batteries				100	1
C&D	5,766	1,380	1,196	3,955	647
Other	551	5,758	20,707	1	1
Total	29,398	27,251	48,237	42,711	40,871
Per Capita Rate (lbs./person)**	290	75	133	292	280

*In tons

**Pounds divided by population

Because of the generally unequal sizes of the populations of the towns, one means of comparing recycling rates among municipalities is to consider annual per-capita recycling. This measure found a correspondence between the rates of commercial recyclables collec-

tion for the two towns (Babylon and Oyster Bay) where no commercial recycling services were provided by the municipality—between 280 lbs./person/year (or pounds divided by population divided by time) and 292 lbs./person/year. The town of Hempstead had smaller rates of recycling in the private sector (75 lbs./person/year in 1993 and 133 lbs./person/year in 1994)—which is understandable, given that Hempstead provided a degree of municipal recycling services to its businesses.

We, therefore, modelled private-sector recycling by using a 290 lbs./person/year rate for those municipalities that did not provide any commercial recycling services to local businesses, and a smaller rate (125 lbs./person/year, which is an approximation of the “more complete” 1994 Hempstead data set) for those municipalities where some recycling services were provided to businesses, or where the drop-off waste management program might be assumed to account for at least some of the commercial recycling tonnage.

Other private-sector recycling activities, where materials were either recovered directly by the generators, or immediately marketed by the generators, were assumed to lead to recovered tonnages, but without any reporting of the tonnages to municipalities. The two examples we included in our assessment of recycling were OCC recycling by supermarkets and yard waste composting by landscaping companies.

The town of Islip discovered that one local supermarket chain (Waldbaum’s, a subsidiary of A&P) was recovering nearly 25,000 tons year of OCC, and dealing directly with marketers through its own warehousing system (located in the town of Islip). Waldbaum’s, in 1994, had slightly under 20 percent of the Long Island market. Therefore, at least 75,000 tons of OCC were being recovered on Long Island in total by Waldbaum’s and through similar systems at other supermarket companies (assuming Waldbaum’s is slightly more efficient at OCC separation than its competitors due to advantages accruing from its local warehousing system).

Bernstein

Another unaccounted-for recycling source is landscaper yard wastes. Landscaping firms have become more common on Long Island, but seem to lack ready disposal points for their collected wastes. Some of the firms do bag leaves and grass clippings and leave them at the curb for municipal collection, but most do not (either as a business choice or due to legal restrictions). Most municipalities that provide composting services restrict landscapers’ access to the facilities. Therefore, it has been a waste management mystery as to the fate of these yard wastes—especially grass clippings. Some of these wastes could be composted in relatively small amounts at local

nurseries, or at the back of staging areas, or on farmland. In terms of round, 25,000-ton lots, it seemed reasonable that at least 75,000 tons of landscaper yard wastes were being recovered *

The combination of uncounted commercial recycling, super-market OCC, and landscaper composting thus added approximately 350,000 tons per year in recycling credits to the municipal totals. (See Table 5.) This is still not a complete accounting for potential additional recycling credits.

Another Source of Recycling Credits

New York State is a “deposit bottle” state, where a nickel deposit is required for certain beverage containers. This measure was initially adopted as an anti-litter policy, but has become part of the arsenal of recycling tools. However, it is New York State policy not to include deposit bottle recoveries as part of local recycling totals.

The town of Hempstead made an estimate of the town-wide redemption rate in 1991. The town found 26,167 tons of deposit containers were redeemed, a rate of 72 lbs./person (or pounds divided by population). This is well above the state average (Three hundred

*This estimate is not as well grounded as the corrugated cardboard estimate. One permitted, privately owned composting site manages 50,000 tons year of a mixture of municipally generated and privately collected leaves. We supposed that 100 small composting sites of between 1/4 acre and 1/2 acre in size also existed, largely as adjuncts to nurseries, or in staging areas for the landscaping companies. New York State uses loading rates of 5,000-7,000 yd³/acre for leaf composting to estimate capacities at permitted facilities (all facilities managing less than 3,000 yds³ do not need a permit). This loading rate, applied to the 100 sites, results in an estimate of 125,000-350,000 yds³ of leaf and grass clipping composting.

With a conversion factors for compost ranging from 3 - 5 yds³/ton, the 100 sites might manage 25,000-100,000 tons of yard wastes in a year. If half the tonnage (25,000 tons) from the permitted site was from private companies, private-sector composting activities could range from 50,000-125,000 tons each year. The estimate we chose was 75,000 tons.

TABLE 5
Additional Commercial Recycling*
(per capita rate in lbs./person/year)

	<i>Modelled Per Capita Rate</i>	<i>Additional Commercial Tonnage</i>	<i>Supermarket OCC</i>	<i>Landscaper Composting</i>	<i>Total</i>
Nassau County		19,000	37,500	37,500	94,000
Glen Cove	125	1,500			
Hempstead					
Long Beach	125	2,100			
North Hempstead	290**	15,500			
Oyster Bay					
Suffolk County		180,000	37,500	37,500	255,000
Babylon	290	29,000			
Brookhaven	290	59,000			
East Hampton	125	1,000			
Huntington	290	28,000			
Islip	290	43,000			
Riverhead	290	3,400			
Shelter Island	125	140			
Smithtown	290	16,000			
Southampton	125	2,800			
Southold	125	1,200			
Long Island Total		200,000	75,000	75,000	350,000
Percent of 3,250,000 Ton Waste Stream		6%	2%	2%	11%

*In tons

**North Hempstead received commercial recycling services for the first half of 1994; thus, only the second half of 1994 is modelled.

CSIResources, Inc.

thousand tons of containers were redeemed in the state as a whole in 1991, suggesting a statewide rate of closer to 30 lbs./person.) However, the affluence of Long Island might allow for greater-than-state-average purchases of the appropriate beverages; therefore, we modelled Long Island recoveries at 50 lbs./person (the approximate mean of the statewide average and the town of Hempstead computation).

The effect of this model was to increase the total recycling credits for Long Island by approximately 75,000 tons. This means that approximately 1.25 million tons were recycled on Long Island in 1994. Our earlier work had shown that the annual waste stream size for Long Island was best considered to be 3.25 million tons—plus or minus 0.25 million tons. Given that additional materials (which may not have been fully accounted for in that earlier estimate) have been included in the recycling total, the base waste generation rate for Long Island (in terms of this recycling accounting) is probably best considered to be between 3.25 million tons and 3.5 million tons. Thus, the overall recycling rate for Long Island could be computed to actually have been between 36 percent and 38 percent in 1994. (See Table 6.)

TABLE 6
Maximal 1994 Long Island Recycling

	<i>Modelled Bottle Recoveries</i>	<i>Municipal Recycling Tonnages</i>	<i>Additional Commercial Tonnages</i>	<i>Total Recycling Tonnages</i>
Nassau County	40,000	508,043	94,000	650,000
Glen Cove	600	3,250	1,500	5,250
Hempstead	26,167	346,418		372,585
Long Beach	800	3,655	2,100	6,600
North Hempstead	5,250	76,442	15,500	97,000
Oyster Bay	7,250	78,278		86,000
Suffolk County	33,000	308,189	255,000	600,000
Babylon	5,000	45,658	29,000	80,000
Brookhaven	10,250	75,500	59,000	145,000
East Hampton	400	6,178	1,000	7,500
Huntington	4,750	56,001	28,000	90,000
Islip	7,500	90,000	43,000	140,000
Riverhead	600	3,000	3,400	7,000
Shelter Island	50	1,000	140	1,200
Smithtown	2,750	13,281	16,000	32,000
Southampton	1,100	9,571	2,800	13,500
Southold	500	8,000	1,200	9,750
Long Island Total	75,000	816,232	350,000	1,250,000
Percent of 3,250,000 Ton Waste Stream	2%	25%	11%	38%
Percent of 3,500,000 Ton Waste Stream	2%	24%	10%	36%

Quantifying Waste Reduction

An additional source of recovery credits, albeit one that is near-to-impossible to quantify, is waste reduction. Various commentators allow consumer purchasing choices, manufacturer product light-weighting, longer product durability, and decisions that lead to waste avoidance (such as double-sided copying, purchases by phone, or e-mail use) to account for large portions of the waste stream. New York State, for example, set a goal in 1987 for such processes to account for 8 to 10 percent of the waste stream "generated" in 1997. Given the overall difficulties of precisely measuring waste generation, it is also unclear how to measure these waste reduction/avoidance effects, or to determine if they result in actual waste stream decreases.

One policy adopted by several municipalities on Long Island that might be measurable is the "Don't Bag It" program for grass clippings and other yard wastes. Don't Bag It programs have been adopted as an environmentally sound means of avoiding fertilizer overuse. These programs allow municipalities to comply with state mandates limiting nitrogen inputs to WTE incinerators, minimizing the inclusion of odor-causing material in compost programs, and reducing costs associated with yard waste management. These programs call for either letting grass clippings remain in place on lawns, or incorporating the clippings into more general at-home composting projects. Either way, the wastes no longer enter the municipal waste stream.

Long Island's total annual per capita waste generation rate is approximately 2500 lbs./person. Most waste audits on Long Island have found that yard wastes account for 15 to 20 percent of the total waste stream. In temperate suburban environments, grass clippings are expected to account for half of all yard wastes. This suggests that 175-250 lbs./person of grass clippings are generated each year. Long Island had one mandatory Don't Bag It program, and nine voluntary programs in 1994. We modelled their effect, using 200 lbs./person of waste reduction for the mandatory program, and 75 lbs./person (approximately one-third participation) for the voluntary programs. The sum of these credits is approximately 70,000 tons. Thus, the overall waste diversion rate on Long Island in 1994 was probably between 37 and 40 percent (1.3 million tons diverted from 3.25 million-3.5 million tons). (See Table 7.)

Ackerman
USEPA 1993
USEPA 1992
The Earth Works Group
NYSDEC 1987

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Discussion

There can be many recycling rates calculated for a particular waste stream. The rate of recoveries depends on how comprehensively the

TABLE 7
Estimated 1994 Long Island Waste Diversion

	<i>Municipal Recycling Tonnages</i>	<i>Additional Recycling Credits</i>	<i>Total Recycling Tonnages</i>	<i>Don't Bag It Tonnages</i>	<i>Total Waste Diversion Tonnages</i>
Nassau County	508,043	130,000	650,000	11,000	650,000
Glen Cove	3,250	2,100	5,250		5,250
Hempstead	346,418	26,167	372,585		372,585
Long Beach	3,655	2,900	6,600		6,600
North Hempstead	76,442	20,750	97,000		97,000
Oyster Bay	78,278	7,250	86,000	11,000	97,000
Suffolk County	308,189	290,000	600,000	60,000	650,000
Babylon	45,658	34,000	80,000		80,000
Brookhaven	75,500	70,000	145,000	15,000	160,000
East Hampton	6,178	1,400	7,500		7,500
Huntington	56,001	33,000	90,000	7,000	96,000
Islip	90,000	51,000	140,000	30,000	170,000
Riverhead	3,000	4,000	7,000	900	8,000
Shelter Island	1,000	190	1,200	100	1,300
Smithtown	13,281	19,000	32,000	4,000	36,000
Southampton	9,571	3,900	13,500	2,000	15,500
Southold	8,000	1,700	9,750	750	10,500
Long Island Total	816,232	425,000	1,250,000	70,000	1,300,000
Percent of 3,250,000 Ton Waste Stream	25%	13%	38%	2%	40%
Percent of 3,500,000 Ton Waste Stream	24%	12%	36%	2%	37%

recyclables are tabulated, and how the underlying waste stream is computed. We were able to find a maximal 37 to 40 percent recovery rate for Long Island in 1994. This is much better than the national rate reported by the US EPA (23.8 percent for 1994, although based on 1997 calculation standards).

USEPA 1998

On the other hand, we believe that most citizens perceive recycling as being the removal of materials such as containers and paper goods from the waste stream generated within buildings. Media attention focuses on such materials, and environmental groups tout the use of these recovered materials as preventing the use of raw, “virgin” materials in manufacturing processes. This makes what we earlier labelled “household recyclables,” “truer” recyclables than the definition that led to the calculation of a 40 percent recovery rate for Long Island.

The household recyclables accounted for only one-third of the baseline municipally reported recycling tonnages in 1994, amounting to less than 10 percent of the entire Long Island waste stream (although some of the additional recycling tonnages we added to the baseline tonnages did include household recyclables-type materials,

too). Restricting the considerations to the residentially generated waste stream (usually estimated at half the entire Long Island waste stream) would suggest that households only separate for recycling something less than 20 percent of the MSW they generate. This rate appears to have plateaued in most of the Long Island municipalities that provide collection services, despite additions, over time, to the lists of acceptable recyclables.

This also means that most of Long Island's recycling credits come from recovering materials in a process that the general public does not perceive as being "recycling."

This leads to two problems. One is that the public has an unjustified pride in the amount of materials that have been diverted from the waste stream. The average citizen hears reports that the Long Island recycling rate is more than 35 percent, and so believes that over a third of all household wastes are being recycled. The true recovery rate is probably half that.

The second problem may arise if the public comes to believe it has been deceived. This could occur if the public came to understand that the high local recycling rates were primarily built by counting materials other than those perceived as being the real recyclables.

In general, it is not wise to evaluate a public policy using measures that are much different from what is more generally believed to be proper measurement means. This is especially true for a process that depends on voluntary participation by the general public to be successful. Such misperceptions may result in an all-too-common reaction—the public's frustration when a discovery is made that it has been misled by policy makers in pursuit of an end different from that originally touted to that public to gain its support. An understandable reaction would be a loss of support for the specific program (recycling, in this instance), and another addition to the general public's loss of confidence in the workings of government.

A revision to current practices to make quantifying recycling more consistent would be to only count materials as they are actually reused. This strict definition seems not to match the public's understanding of recycling—the setting aside of recyclable materials either at the curbside or at a recycling center. The public does not consider "closing the loop" an essential component of recycling—but it is. Citizen efforts would be underrepresented if only reconstituted materials were counted.

We suggest the following two steps. First, redefine recycling rates so as to match general perceptions. Second, increase public educational efforts so as to broaden the public's understanding of waste stream recoveries. We believe the more pragmatic approach

would be to recast regulatory definitions of recycling rates to more closely match the public's own definitions. This would lead to lower recycling rate reports than currently are used and require policy goals to be ratcheted down accordingly. However, the dissonance between public perception and regulator concerns would be lessened. For example, although yard wastes are a major waste stream component, it is far from clear that the original intent of waste reduction and recycling efforts was to preserve the nation's resources by eliminating yard wastes from disposal sites. Yet the data show that yard wastes and wood provide the lion's share of recycling credits on Long Island.

It is still essential to encourage the recovery of other materials, and to measure those efforts. However, it may be that these efforts should not be counted as strict recycling. Different categories (yard waste recovery, materials disposal avoidance) could be created to avoid overuse of a popularly understood and defined term—recycling.

Bibliography

- F. Ackerman, *Why Do We Recycle?* (Washington, D.C.: Island Press, 1997).
- J. Bernstein, "LI Foodstores Go Dutch in \$2.9B Stop and Shop Buy," *Newsday* (March 29, 1996).
- CSI Resources, Inc., *Town of Hempstead Solid Waste Management Plan and Comprehensive Recycling Analysis for the Planning Period: 1992 to 2010* (Boston: CSI Resources, Inc., 1993).
- The Earth Works Group, *50 Simple Things You Can Do to Save the Planet* (Berkeley: Earthworks Press, 1989).
- Franklin Associates, *Characterization of Municipal Solid Wastes in the United States, 1960 to 2000* (Prairie Village: Franklin Associates, Ltd., 1986).
- J. Glenn, "The State of Garbage," *BioCycle* 40:4 (1999) 71.
- Patrick Golden and Janet Matthews, with Violet Moss and Perceval Miller, *Where Will the Garbage Go?* (Albany, NY: Legislative Commission on Solid Waste Management, New York State Assembly, 1998).
- N. Goldstein, "The State of Garbage," *BioCycle* 41:4 (2000) 32-39.
- L.E. Koppleman, *The Long Island Comprehensive Waste Management Treatment Plan* (Hauppauge: Nassau-Suffolk Regional Planning Board, 1978).
- Long Island Lighting Company, *Population Survey, 1994: Current Population Estimates for Nassau and Suffolk Counties and the Rockaway Peninsula* (Hicksville: Long Island Lighting Company, 1994).
- New York State, *Environmental Conservation Law Statutes* (1983) 27:0704.
- New York State, *General Municipal Law* (1988) 120-aa.
- New York State Department of Environmental Conservation, *The New York State Recycling Bulletin*, 1998 edition (Albany: NYSDEC, 1998).
- New York State Department of Environmental Conservation, *Solid Waste Management Facilities* 6NYCRR Part 360 (Albany: NYSDEC, 1997).
- New York State Department of Environmental Conservation, *The New York State Solid Waste Management Plan* (Albany: NYSDEC, 1987).
- Newsday*, "Breaking Down the Lottery" (chart), *Newsday* (December 4, 1995).
- Office of Technology Assessment, *Facing America's Trash: What Next for Municipal Solid Waste?* OTA-O-424 (Washington, D.C.: GPO, 1989).
- W.L. Rathje, "The Percentage Paradox of Recycling," *MSW Management* 8:2 (1998) 10.

P. Reuter, *Racketeering in Legitimate Industries: A Study in the Economics of Intimidation* (Santa Monica: The Rand Corporation, 1987).

D.J. Tonjes and R.L. Swanson, *Extending the Definition: Waste Reduction, and Municipal and Private Sector Recycling Rates on Long Island in the 1994: Part IV of an Assessment of Recycling on Long Island* (Stony Brook: Marine Sciences Research Center, SUNY at Stony Brook, 1997).

D.J. Tonjes and R.L. Swanson, *Comparing Apples and Oranges: Municipal Recycling Tonnages and Rates on Long Island in the 1990s: B. The Data Analysis: Part II of an Assessment of Recycling on Long Island* (Stony Brook: Marine Sciences Research Center, SUNY at Stony Brook, 1996).

D.J. Tonjes and R.L. Swanson, *Doing the Right Thing: Municipal Recycling on Long Island: Part I of an Assessment of Recycling on Long Island* (Stony Brook: Marine Sciences Research Center, SUNY at Stony Brook, 1996).

D.J. Tonjes and R.L. Swanson, *Plumbing the Unknown: Recycling Practices, Tonnages, and Rates in the Private Sector on Long Island in the 1990s: Part III of an Assessment of Recycling on Long Island* (Stony Brook: Marine Sciences Research Center, SUNY at Stony Brook, 1996).

D.J. Tonjes and R.L. Swanson, "Long Island's Solid Waste Perplexities," *The Journal of Urban Technology* 1:3 (1994) 21-46.

United States Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1997 Update*, EPA 530-R-98-007, prepared by Franklin Associates (Washington, D.C.: GPO, 1998).

United States Environmental Protection Agency, *Measuring Recycling: A Guide for State and Local Governments*, EPA 530-R-97-011 (Washington, D.C.: GPO, 1997).

United States Environmental Protection Agency, *A Business Guide for Reducing Solid Waste*, EPA 530-K-92-004 (Washington, D.C.: GPO, 1993).

United States Environmental Protection Agency, *The Consumer's Handbook for Reducing Wastes*, EPA 530-K-96-003 (Washington, D.C.: GPO, 1992).