

**ANALYSIS OF TECHNOLOGY AND INFRASTRUCTURE OF THE  
PAPER RECYCLING INDUSTRY IN NEW YORK CITY**

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**Submitted in partial fulfillment of requirements for M.S. thesis in  
Earth Resources Engineering**

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Fu Foundation of School of Engineering and Applied Science, Columbia  
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**Research sponsored by:  
Visy Paper, The Earth Engineering Center, and the Henry Krumb School of Mines**

**May 2004**



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**Executive Summary**

The objective of this study was to examine the technology and infrastructure of paper recycling in New York City and devise ways for increasing paper recovery. At present, “residential” wastepaper is collected as a separate stream by the Department of Sanitation of New York City (DSNY). In 2003, DSNY collected approximately 414,960 tons of paper, i.e. about 35 percent of the estimated paper discarded in the residential stream. The “commercial” paper generated by private businesses and collected by several private carters amounts to approximately 800,000 tons per year. The NYC commercial paper recycling rate is about 69 percent. The total amount of NYC paper wastes, both residential and commercial, is estimated at about 2,360,000 tons per year. Therefore, the overall paper recycling rate is 50.5 percent, slightly higher than the reported U.S. rate for paper recycling.

Most technology used by paper recyclers is very simple, usually consisting of a tipping floor; an inclined conveyor; and a line of workers manually sorting waste paper by three or four grades. The higher-tech recyclers have more recent technology resulting in faster sorting. Visy Paper in Staten Island is the only true “recycler” of paper, turning recovered residential and commercial waste paper into finished paper products.

Paper recycling has been occurring in New York City since the end of the 19<sup>th</sup> Century. The deep roots of the industry have allowed it to reach impressive levels of capture of commercial wastepaper: Recycling rates in the three busiest boroughs, in terms of commercial activity (Manhattan, Brooklyn, Queens), are about 75 percent while Bronx and Staten Island attain commercial rates of 50 and 37 percent, respectively.

The tonnage of residential paper recovered in New York City decreased from 1186 tpd in 2001 to 1026 tpd in 2003<sup>1</sup> in the aftermath of the suspension of glass and plastics recycling by the City. However, the Department of Sanitation runs in all boroughs an extensive (and expensive) curbside collection program that is the largest such program in the United States. While the residential paper recycling rate of 35 percent is one half the commercial paper rate, the incentives and motivation are substantially different.

Residential paper recycling rates would increase – and collection costs decrease – if the city were to implement a single stream collection system. 22 out of 59 sanitation districts currently use dual-bin trucks for recycling, with one side filling up before the other, thus resulting in the need to return at the Material Recovery Facilities (MRF) with less than a full load. This in turn leads to higher collection costs, which was one of the reasons Mayor Bloomberg suspended the plastic and glass portion of the program in 2002 – which inadvertently affected paper collection. If recycling becomes more cost competitive to landfilling, the temptation to discontinue the program in difficult financial times will presumably disappear. A consistent program is vital to the continued improvement of recycling rates in the City.

The City also needs to explore innovative programs that capture the attention of busy New Yorkers and increase the rate of residential recycling. One such idea may be incentive-based recycling (IBR), which will be tested in a pilot program in Philadelphia later this year. In this program residents are rewarded based on how much they recycle; if this program is successful, Visy Paper and other companies may consider sponsoring a pilot program in Staten Island. A program of this nature may be particularly helpful in increasing participation in low-diversion areas of NYC. Curbside recycling rates vary widely from neighborhood to neighborhood – from a low 7 percent to a high of 32 percent. Higher rates are usually found in higher income neighborhoods.

The City and DSNY need to take greater advantage of the presence of Visy Paper and their significant local infrastructure and resources. For example, an agreement could

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be made whereby the City commits increased residential paper tonnage to Visy and the company helps fund an aggressive advertising campaign.

There are other opportunities for Visy Paper to increase its supply of NYC used paper. For example, by partnering with online businesses that ship goods in corrugated cardboard to customers in NYC, such as Amazon or FreshDirect, Visy could promote their image as the local paper recycler as well as gain new customers for VisyBoard. Sharing a storefront with an operation like the UPS Store, which sells packing materials (primarily corrugated cartons), would provide similar benefits.

**Summary of New York City Paper Recycling Rates**

Paper Recycling	Residential	Commercial	NYC Total, both streams
Waste paper generation, tons per year	1,201,200	1,157,621	2,358,821
Waste paper recovery, tons per year	414,960	799,280	1,214,240
Paper recycling rate	34.5%	69%	50.5%

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<sup>2</sup> [http://www.comptroller.nyc.gov/bureaus/opm/reports/Recycling\\_Cost\\_Projections\\_for\\_City\\_Council\\_REPORT.pdf](http://www.comptroller.nyc.gov/bureaus/opm/reports/Recycling_Cost_Projections_for_City_Council_REPORT.pdf)

## **Acknowledgements**

Firstly, I must give profound thanks to Professor Nickolas J. Themelis, who has been the advisor and mentor most people only dream about having. I feel very fortunate to have been able to work closely with him.

The support of Visy Paper made the two years of research that this study required possible; the openness and willingness of their executives and employees to share information and ideas made it very pleasurable. I would particularly like to thank Helmut Konecsny, Andrew Hayes, Leanne Lobo, Daryl Whitehead, Judy Goodstein, Muneer Ahmad, Ryan McMullen, Ron Hardwick, and David Leung for their support and guidance.

Maite Quinn of Sprint Recycling gave hours of her time and her intimate knowledge of the paper industry was of immeasurable help in this study. Her colleagues at Sprint, especially Jeff, were equally giving and helpful.

Several other paper industry insiders lent me time and wisdom. Among them are David Benedetto at Chambers Fibers and Taylor Pine at Five Star Recycling. Bob Schulman of the Business Integrity Commission was extremely generous with his advice (and data!). Allen Hershkowitz of the Natural Resources Defense Council provided valuable information and expertise, and generally helped me to understand more about recycling in New York. Eileen Berenyi offered her expert advice and suggestions.

I would also like to recognize (in no particular order) Masato Nakamura, Liliana Themelis, Kari Ostrem, Monica Deangelo, Frank Yeboah, Alex Whitworth, Barbara Algin, Jaime Bradstreet, Professor Upmanu Lall, Professor Klaus Lackner, and Kimberly Labor from Columbia University's Earth Engineering Center for their strong support. I have special appreciation for Dr. Karsten Millrath and Dionel Albina, both of whom were (and continue to be) patient and skillful teachers of mine.

Finally, thanks to Rachel Solomon and to my family for helping me along the whole way through.

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## 1. History of Paper Recycling in New York City

It would be impossible to adequately understand any aspect of commercial waste management in New York City without some background on the underworld's involvement from the beginning of the 20<sup>th</sup> century through the late 1990s. Before New York City passed laws in 1992 requiring all businesses to source separate their recyclables,<sup>3</sup> the world of commercial garbage hauling was controlled by mob bosses, while the paper recycling industry was run by legitimate, often family-owned corporations.

As soon as the law was passed, mob-owned carters began infiltrating the paper collection routes, intimidating established recyclers and claiming entire “territories” for themselves. Paper recycling quickly became a part of the vast mafia garbage cartel, controlled mainly by five major crime families. Zones of operation were established, with “no price-cutting, no open warfare, and all territorial disputes solved by bosses.”<sup>4</sup> In stark contrast, the paper recycling businesses had operated for nearly a century under free-market guidelines – recyclers would bid on the paper waste generated by a building or business, with the lowest bidder “winning” the contract. In this way, used paper grew in value as a commodity, and its associated recycling infrastructure was firmly established over a period of 100 years. This explains the much greater success of commercial paper recycling over its less-established sister industries – glass and plastics.<sup>5</sup>

Because the mafia arrangement was predicated on collusion, the tradition of open competition among paper recyclers was unwelcome in the new order. Paper recyclers – regardless of their history of service and well-established procedures, were expected either to leave areas altogether (forced out by intimidation), or to join in the conspiracy.<sup>6</sup> Chambers Paper Fibers, established in 1896, was a victim of this strong-arming. Its drivers were routinely threatened and became afraid to collect from regular customers.

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<sup>3</sup> New York City Local Law 87.

<sup>4</sup> The account of the mob's involvement in waste management and paper recycling can be learned in detail in the book *Takedown*, written by Rick Cowan, the undercover detective who broke the cartel.

<sup>5</sup> Steel has a similar history of success.

<sup>6</sup> A legally-recognized entity, the New York Waste Paper Removers and Packers Association, Inc., served as the organizing body. It was formed in 1946 – which attests to some mafia involvement in paper recycling even as far back as the mid-20<sup>th</sup> Century – and always had ties to the mafia.

Late in 1992, Rick Cowan, an undercover detective with the New York City Police Department, witnessed the fire-bombing of one of Chambers' truckers. This led to his infiltration of the mafia stronghold on commercial hauling and recycling, under the assumed identity of Danny Benedetto, the "long-lost cousin" of Sal Benedetto, the fourth-generation owner of Chambers.

It took two years for Cowan to gather enough evidence to bring down the mafia cartel. The effort was, by all accounts, a success and the commercial carting industry is now regulated by a City government agency created strictly for this purpose – the Business Integrity Commission (BIC), formerly known as the Trade Waste Commission. Maximum tonnage prices are set by the government and enforced by BIC's field staff,<sup>7</sup> and the commercial waste hauling, processing, and recycling industry is now widely regarded as "legitimate."<sup>8</sup> Additionally, the teamsters' union, which counts many commercial sanitation workers among its ranks, has shed its mafia-related leadership.<sup>9</sup>

In the early days of recycling, collected materials could not be transported over long distances, as is now common among haulers. Some recyclables were loaded onto barges and sent up the Hudson River to mills north of the City. Most were used as feedstock in facilities within New York and New Jersey, until rail freight became the predominant mode of long-distance shipping of recyclable materials in the 1950's and 1960's. In the late 1960's, overseas exports began to factor into recycling options, such as mills in Italy importing used paper. In the late 1970s and early 1980s, countries in Asia – especially Taiwan and China – started importing NYC fibers. This grew more and more common until current times, when most collected paper is shipped overseas.

Though the industry has been through many changes and several difficult periods, it still consists mostly of small, family-owned businesses. When the mafia was brought

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<sup>7</sup> BIC is notoriously understaffed, and the effectiveness of enforcement is somewhat questionable (this will be discussed later in this report). There is some concern among city waste industry insiders that the mafia has once again begun to operate in NYC, but that their influence has lessened almost completely.

<sup>8</sup> Mafia lawyers, in defending their clients following Cowan's successful undercover infiltration, tried to play up the similar stronghold on waste hauling currently held by industry giants such as Waste Management and BFI. There is a noticeable trend towards greater corporate ownership of waste routes, but there is also no questioning the ability of smaller entities to safely and legally submit competing bids for services.

<sup>9</sup> Before the infiltration of the NYPD, teamsters' leaders, under mob boss orders, would use sanitation worker strikes to cripple the city and win demands of higher compensation for waste services.

down, it was thought that large corporate waste haulers like Waste Management and BFI would take over as the dominant players. This did not turn out to be the case. New York business owners are notoriously demanding, and each neighborhood in the city contains its own distinctive mix of buildings and business types.

## **2. Wastepaper in New York City**

### 2.1 Residential Collection by DSNY

The Department of Sanitation of New York City (DSNY) is responsible for collecting 13,000 tons per day of residential and institutional waste (black bags). In addition, they have collected between 1000 and 1600 tons per day of source separated paper, as well as 200 to 1200 tons per day of source separated metal, glass, and plastic (MGP).<sup>10</sup> The above variance in recyclables collected per day is due to the temporary suspension in April, 2002 of glass and plastic recycling. An unforeseen consequence of this suspension was the dip in average paper collected for recycling by DSNY by roughly 300 tons per day<sup>11</sup>, presumably due to confusion on the part of the public.

To determine the amount of paper waste actually generated within the DSNY collection routes, it is useful to know the approximate percentage of paper in the city's black bag waste. Various attempts have been made to characterize New York City's black bag waste. One such study was performed by DSNY in 1999<sup>12</sup>. It concluded that about 21 percent of black bag waste was "potentially recyclable paper."

In a "spot" check of these data, the author led a team of scientists from the Earth Engineering Center (EEC) at Columbia University in a representative waste sort. Sixty black bags were collected from DSNY routes in various neighborhoods of the Morningside Heights area of Manhattan. The bags were opened in the laboratory, the contents were hand-sorted, and recyclable paper was set aside to be weighed. The results showed that the weight of the recyclable paper represented 23 percent of the black bag waste.

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<sup>10</sup> DSNY 20 yr recycling RFP

<sup>11</sup> DSNY *RFP to Manage Recyclables*, Appendix III

<sup>12</sup> [http://www.nycwasteless.org/gov/pdfs/mixed\\_waste.pdf](http://www.nycwasteless.org/gov/pdfs/mixed_waste.pdf)

By assuming 312 collection days<sup>13</sup>, 21 percent paper thrown out in the black bags (DSNY study) and 1300 tons per day of source separated paper, the paper waste generated per year by the DSNY-served sectors of New York City is as shown in Table 1:

**Table 1 Estimated DSNY Paper waste generated per year**

<b>Category</b>	<b>Short tons</b>
Source separated paper collected with full recycling program (i.e. including before discontinuing glass and plastic)	414,960
Paper remaining in black bags	786,240
Total waste paper generation	1,201,200
DSNY-collected total MSW (recycled plus black bag) <sup>14</sup>	3,744,000
% Paper in total DSNY stream	32.1%
Paper collected as % of paper discarded (Paper Recycling Rate)	34.5%

Table 1 shows that the estimated 1.2 million tons of paper waste in the NYC DSNY stream represents approximately 32 percent of the total DSNY collection of municipal solid wastes. Also, the capture rate<sup>15</sup> of paper by DSNY is 34.5 percent. It should be noted that that these numbers are when the full paper-metal-glass-plastics recycling program was in place during 2001 and the overall recycling rate was about 20 percent (the highest ever achieved by DSNY), in 2001.<sup>16</sup>

<sup>13</sup> NYC Independent Budget Office. *Inside the Budget*. February 2001.

<sup>14</sup> NYC Independent Budget Office. *Overview of the Waste Stream Managed by the NYC DOS*.

<sup>15</sup> The term “capture rate” is used to differentiate between paper suitable for Visy Paper and other contractors. Because Visy’s feedstock is mixed paper, items such as clean food paper (i.e. clean paper cups, plates, etc.) and crumpled miscellaneous paper are included.

<sup>16</sup> NYC Independent Budget Office, February 2001

## 2.2 Commercial Collection by Private Carters

Commercial waste paper has until recently been more difficult to quantify, for two main reasons. Firstly, it is difficult to track the large number of commercial carters – there are at least sixteen major carters that collect commercial wastepaper in New York City. Many of these are old, family-owned businesses that are very secretive about their collection routes and other information. In addition, many of these carters change ownership and/or names frequently, making consistent studies problematic<sup>17</sup>.

The second complicating factor is the sheer number of businesses in New York City. There are over 150,000 commercial entities in New York<sup>18</sup>, ranging from tiny, privately owned and operated convenience stores to large, corporate megastores. New York City is simply unparalleled in North America – and most likely in the world – in terms of the density and activity of its commercial sector.

For the purposes of this study, EEC was able to obtain data collected by the Business Integrity Commission (BIC) – the former Trade Waste Commission and licensing authority for commercial carters in the city – that canvassed more than 90 thousand carter “stops” throughout the five boroughs. These data represent the results of surveys sent by BIC to all commercial carters requiring the carters to record the names and addresses of their customers, along with the types of materials collected and their ultimate destinations.

To protect privacy, the names and addresses of businesses were not provided to EEC. We were, however, given ZIP codes, types of business, and ultimate destination of the paper. These collection data, which did not involve tonnages but did include number and types of businesses recycling paper, were useful in determining market sectors with relatively high and low paper recovery. Table 2 summarizes the results for selected business types in Manhattan (the category “none of the above” has been omitted).

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<sup>17</sup> In the two years between the current study and Todd’s thesis, one of the carters common to both studies has changed names.

<sup>18</sup> Source: Bureau of the Census, US Department of Commerce. In 1994, the last year with published data, there were 175,403 business establishments in the city.

**Table 3 Manhattan businesses recycling paper (BIC data)**

Business Type	Total Number Businesses	Number of businesses recycling paper	% of businesses recycling paper
Heavy manufacturing	90	67	74.4%
Light manufacturing	973	325	33.4%
Wholesale – Non-food	1159	936	80.8%
Wholesale – Food	164	38	23.2%
Office Bldg - large	817	679	83.1%
Office Bldg – medium	2236	1833	82.0%
Office Bldg - small	6256	4475	71.5%
Hotels – large	176	46	26.1%
Hotels – small	105	30	28.6%
Retail – Food	2952	1162	39.4%
Retail - Non-food	8946	4833	54.0%
Auto repair	69	18	26.1%
<b>TOTALS</b>	<b>28384</b>	<b>16277</b>	<b>57.3%</b>

Further research indicated that some of the participation numbers shown in Table 2 are not entirely reliable. For example, Richard Fuller, President of Great Forest, Inc., a senior waste consultant in New York City, claims that at least 90 percent of big hotels participate in paper recycling<sup>19</sup>. It is simply in the best economic interests of these types of businesses to separate their waste paper, which is either picked up free of charge (therefore lowering overall waste hauling costs) or sometimes even paid for by carting companies.

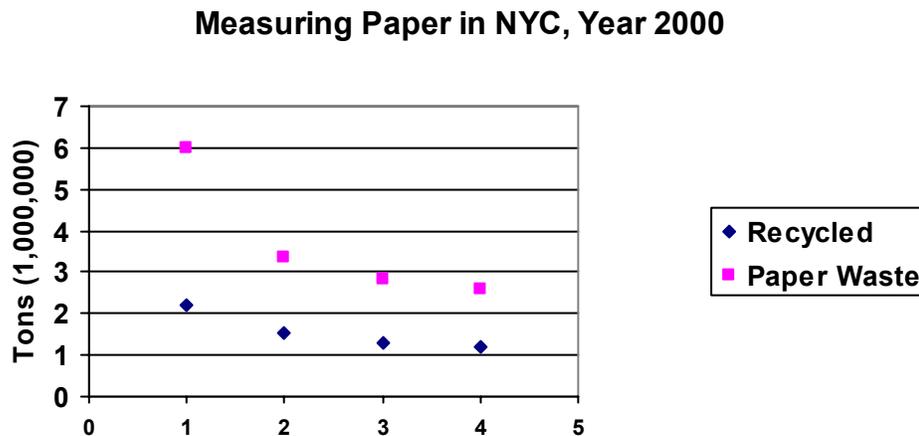
In order to determine the amount of paper waste in New York’s commercial waste stream, EEC has used several methods in combination. They can be generalized in the following two different ways:

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<sup>19</sup> Richard Fuller, personal communication.

**a) Estimation from literature.** In the early stages of research, EEC used four different methodologies to estimate the amount of paper generated, disposed, and recycled in New York. These estimates were based on literature widely available through the internet, academic books, and trade publications. Method 1 used numbers published in DSNY’s *Preliminary Commercial Waste Report*; Method 2, population-derived statistics; Method 3, U.S. Environmental Protection Agency (EPA) numbers of per capita generation numbers; finally, Method 4 utilized the American Forest and Paper Association’s (AF&PA) national paper recycling rate and applied it to New York City demographics to arrive at total tonnages of paper generated, recycled, and disposed. Figure 1 summarizes the results of the four methods.

**Figure 1 EEC early-phase estimates on NYC paper waste**



The trend from Method A to Method D (i.e. 1 through 4 in Figure 1) reaches closer and closer to the final estimates EEC calculated, as will be shown in the following sections.

**b) Commercial Waste Management Study (DSNY, April, 2004).** The release, in April 2004, of this long-awaited and comprehensive study made it a great deal easier to calculate the quantity of paper generation and recycling in NYC. The Department of Sanitation of New York City commissioned this study (by order of the New York City Council), which was carried out by an independent engineering firm to determine the amounts and types of commercial waste generated in the five boroughs. It showed that

the NYC commercial sector generated 3,085,370 tons of recyclable and putrescible<sup>20</sup> wastes in 2002.<sup>21</sup> Of this total, approximately 824,000 tons were recovered for recycling and most of the recovered material was paper<sup>22</sup>.

### 2.3 Quantifying the paper generation in the NYC commercial waste stream

The *Commercial Waste Management Study* (CWMS) was performed by a prominent engineering firm, HDR, and took nearly two years to complete. There were three primary methods employed by HDR in its tonnage estimates:

a) **DSNY quarterly facilities reports.** Under New York City (NYC) law, waste facilities are required to report tonnages handled on a quarterly basis. HDR analyzed these reports to derive a yearly tonnage figure.

b) **Hauler and facility surveys.** HDR used several subcontractors to survey waste handlers inside and outside of New York City and aggregated these surveys to provide a citywide waste generation estimate.

c) **Employment-based estimates using national numbers.** Using rates determined by Franklin Associates, a consulting firm that is well-known in the waste industry, HDR applied a per-employee waste generation rate to industry employment statistics to arrive at a citywide generation total.

Taking all of these methods into account, HDR estimated that New York City generates 9,889 tons of commercial waste per day,<sup>23</sup> which translates into 3,085,370 per year. EEC then derived the estimated percentage of paper in the waste stream by multiplying the HDR generation tonnage by the percentage of commercial waste generated by business category (Table 2.1.2-1 in the *CWMS*). Finally, the above data were combined with data from the California Integrated Waste Management Bureau (CIWMB 2004) on the characterization of commercial municipal solid wastes by business category<sup>24</sup> to yield the estimated tonnages of paper generated by each type of business in NYC in 2003 (Table 3)

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<sup>20</sup> Putrescible waste is loosely defined as any waste product that is *not* C&D or fill material

<sup>21</sup> <http://www.nyc.gov/html/DSNY/pdf/pubnrpts/cwms-ces/v2-cwgp.pdf>, page 24

<sup>22</sup> <http://www.nyc.gov/html/DSNY/pdf/pubnrpts/cwms-ces/v2-cwgp.pdf>, page 24

<sup>23</sup> <http://www.nyc.gov/html/DSNY/pdf/pubnrpts/cwms-ces/v2-cwgp.pdf>, page 20

<sup>24</sup> <http://www.ciwmb.ca.gov/WasteChar/BizGrpCp.asp>

**Table 6 Estimated commercial wastepaper generated in New York City in 2003 <sup>a</sup>**

Business Category	Percent of Commercial Waste Generation (CWMS) <sup>25</sup>	Waste generated, in NYC by business category, tons	Paper as % of waste generated by business category <sup>b</sup> (CIWMB)	Paper wastes generated in NYC, tons
Construction	1.6%	49,366	20.4%	10,071
Finance & Insurance	4.5%	138,842	50.4%	69,976
Real Estate	1.6%	49,366	50.4%	24,880
Manufacturing*	6.2%	191,293	28.5%	54,518
Wholesale Trade*	5.3%	163,525	38.2%	62,466
Retail Trade	22.4%	691,123	34.5%	238,437
Transport & warehousing	2.5%	77,134	34.9%	26,920
Utilities	0.3%	9,256	68.2%	6,313
Information*	3.4%	104,903	59.9%	62,837
Professional/Tech/Sci*	5.8%	178,951	40.8%	73,012
Mgmt of Companies*	1.1%	33,939	40.9%	13,881
Admin Support Svcs*	4.0%	123,415	40.9%	50,477
Health Care	12.9%	398,013	47.5%	189,056
Arts/Entertainment*	1.4%	43,195	33.2%	14,341
Hotels & Food Services*	21.9%	675,696	30.0%	202,709
Other Services*	2.9%	89,475	33.2%	29,706
Unclassified & Other*	0.4%	12,341	39.9%	4,924
State/Fed Government	1.9%	58,622	39.4%	23,097
<b>Total New York City</b>	<b>100%</b>	<b>3,088,455</b>	<b>37.5%</b>	<b>1,157,621</b>

<sup>a</sup>Totals may not match due to rounding. <sup>b</sup>Note that percentages are calculated *after* recycling is accounted for in CIWMB study, therefore, actual percentages are likely to be larger in NYC. \* Asterisk denotes business categories in DSNY CWMS that do not have exact matches in the CIWMB characterizations. Most similar categories were chosen.

<sup>25</sup> From *Commercial Waste Management Study* Table 2.1.2-1, which shows percent waste generated in New York City by business category

The CIWMB characterization report also breaks down paper by percentage of type/grade of various paper wastes. It is therefore possible to estimate the amounts of commercial wastepaper generated by type of paper. Combining the CIWMB data on paper types with the paper tonnages derived above, the wastepaper types generated in New York City in 2003 are estimated as shown in Table 4.

**Table 7 Estimated commercial wastepaper generated NYC 2003, by type**

<b>Material Type</b>	<b>Paper generated, tons</b>	<b>% of total paper</b>
Uncoated Corrugated Cardboard	217,596	18.8%
Paper Bags	25,340	2.2 %
Newspaper	89,985	7.8%
White Ledger	94,789	8.2%
Color Ledger	7,871	0.7%
Computer Paper	13,644	1.2%
Other Office Paper	63,420	5.5%
Magazines and Catalogs	55,713	4.8%
Phone Books and Directory	5,578	0.5%
Other Miscellaneous Paper	135,642	11.7%
Remainder/Composite Paper	414,220	35.8%
<b>Total Paper</b>	<b>1,157,622</b>	<b>100%</b>

#### 2.4 Quantifying the recycling of paper from the NYC commercial stream

The amount of paper recycled can be derived from additional data on recycling in the *CWMS*. According to the *CWMS*, approximately 27 percent of commercial putrescible waste generated in 2003 was recycled, totaling 824,000 tons. In 2002, the last year a breakdown of commercial recyclables was provided by *CWMS*, approximately 97

percent of recyclables collected was paper.<sup>26</sup> Therefore, during 2003, the commercial recycling of paper in NYC was approximately (824,000 \* 0.97), or 799,280 tons. Comparison of this number to the estimated rate of paper generation in NYC of 1,157,621 (Table 3) leads to the conclusion that the paper recovery rate from the commercial stream was 69 percent. This rate is 2 times as much as the rate of recovery of paper from the DSNY residential stream. (34.5%).

**Table 8 Summary of estimated Paper Generation and Recycling** in commercial NYC stream for 2003

Generated paper wastes, tons	1,157,621
Recycled total wastes,,, tons	824,000
Recycled paper as % of total materials recycled, %	97.0%
Recycled paper, , tons	799,280
<b>Recycled paper as fraction of generated paper,</b>	<b>69.0%</b>

## 2.5 Commercial Paper Recycling by NYC Borough

Using data provided in the *CWMS study*, it is possible to estimate the paper recycling rates of each borough in New York City. HDR Engineers derived commercial waste generation and recycling tonnages for each borough. The paper generation tonnages for each borough were estimated using these data and assuming that 37.5 percent of commercial putrescible waste generation is paper (see Chapter 2.3 and Table 2). To estimate paper recycling tonnages and rates for each borough, the recycling tonnages provided by the Commercial Waste Report were multiplied by 0.97 (the approximate percentage of paper in the overall commercial recycling stream). The results are shown in Table 7.

<sup>26</sup> <http://www.nyc.gov/html/DSNY/pdf/pubnrpts/cwms-ces/v2-cwgp.pdf>, page 13

**Table 9 Estimated Commercial paper recycling by borough, 2003**

Borough	Waste Generation, tons <sup>27</sup>	Paper generation, tons	Paper recycled, tons <sup>28</sup>	Commercial paper recycling rate, %
Bronx	398,000	149,250	74,690	50.4%
Brooklyn	599,000	224,630	169,750	75.6%
Manhattan	1,306,000	489,750	361,810	73.9%
Queens	623,000	233,630	170,720	73.1%
Staten Island	160,000	60,000	22,310	37.2%

According to these figures, the Brooklyn, Manhattan, and Queens paper recycling markets are saturated. If there is to be improvement in commercial paper recycling in NYC, Staten Island and The Bronx are the best places to begin. If an arbitrary target of 75 percent paper recycling were set for each borough – which is clearly attainable based on the rates achieved in Manhattan, Brooklyn, and Queens – there are an additional 22,690 tons in Staten Island and 37,248 tons in The Bronx readily available.

It is unclear why Staten Island and The Bronx are less successful diverting commercial paper from landfills. One possible reason is the lower density of waste producers. According to the BIC study mentioned earlier, Manhattan, Brooklyn, and Queens represent 37, 29, and 20 percent of all carter customers, for a total of 86 percent of all businesses in New York City. The Bronx represents only 11 percent of the total businesses in New York, while Staten Island totals just over 3.5 percent. Land area is not likely to be a factor: As shown in Table 7, Manhattan, with the smallest land area, has the highest share of businesses.

<sup>27</sup> *Commercial Waste Report*, page 25.

<sup>28</sup> *Commercial Waste Report*, page 26.

**Table 10 Land areas and percent of total businesses of NYC boroughs**

<b>Borough</b>	<b>Land Area (sq.miles)</b>	<b>Share of Businesses (%)</b>	<b>Commercial Paper recycling rate</b>
Bronx	42	11	50.4%
Brooklyn	71	29	75.6%
Manhattan	23	37	73.9%
Queens	109	20	73.1%
Staten Island	58	3.5	37.2%
New York City	303	100	69.0%

Travel distances and/or costs may also be a significant factor in the variation of rates of commercial paper recycling among boroughs. For example, to get to a Brooklyn materials recovery facility (MRF) from Staten Island, a truck has to cross the Verrazano Bridge, which costs \$16 for two-axles and \$26 for three-axles. If there is, in fact, unclaimed paper in Staten Island, it would seem a perfect opportunity for Visy Paper or other recyclers to increase feedstock by an estimated 20,000 tons of commercial wastepaper.

## 2.6 Summary of paper wastes generation and recycling in NYC

Wastepaper in New York City is collected in two main streams: “Residential”, by the New York City Department of Sanitation; and “commercial”, by hundreds of private carters. The residential stream originates in the city’s residences, government and nonprofit institutions, while the commercial stream is generated primarily from privately-owned businesses throughout the five boroughs.

The overall residential and commercial waste streams comprise the following tonnages: 3,744,000 tons per year in the case of the residential stream; 3,085,000 tons per year commercial. Of the roughly 6.8 million tons per year of total putrescible waste

generated in New York City, approximately 2.4 million tons, or 34 percent, are paper. At its peak, in 2001, the DSNY collection system captured an estimated 415,000 tons or 34.5 percent of the wastepaper generated by residents and institutions. On the other hand, private carters captured 799,000 tons, or 69 percent of the wastepaper generated by businesses.

The total tonnage of paper collected both by DSNY and commercial carters combined is 1,214,240 tons, or 50.5 percent of all wastepaper generated in New York City in one year. This rate is similar to the 48.1 percent recovery reported by the American Forest and Paper Association, for the U.S as a whole in 2002.<sup>29</sup> The generation and recycling rates of paper in NYC from the residential and commercial sectors are summarized in Table 6.

Table 11 Estimated overall NYC paper generation and recovery rates, 2003

DSNY (residential) total waste generated, tons	3,744,000
DSNY wastepaper generated, tons	1,201,200
DSNY paper as percent of total DSNY waste	32.1%
DSNY paper recycling, tons	414,960
DSNY paper recycling rate, percent	34.5%
Commercial total waste generated, tons	3,085,000
Commercial wastepaper generated, tons	1,157,621
Commercial paper as percent of total commercial waste	37.5%
Commercial paper recycling, tons	799,280
Commercial paper recycling rate, percent	69.0%
TOTAL wastepaper generated in NYC, all sources	2,358,821
TOTAL paper as percent of NYC waste, all sources	34.5%
TOTAL paper recycling NYC, all sources, tons	1,214,240
<b>OVERALL NYC PAPER RECYCLING RATE, ALL SOURCES</b>	<b>50.5%</b>

<sup>29</sup> AF&PA, [www.afandpa.org](http://www.afandpa.org).

### 3. Paper Recycling Facilities

Paper recycling facilities in and around New York City are essentially Material Recovery Facilities (MRF) that sort the collected paper to marketable feedstocks. They receive wastepaper – either from their own truck routes or through purchasing paper collected by other haulers – in loose or baled form, which they sort out to different grades and resell to paper recycling mills. There are currently roughly 30 such paper recyclers in the New York metropolitan area.<sup>30</sup>

The recycling process at most facilities is quite simple. There is usually a tipping floor, an inclined conveyor belt, and a group of workers pulling materials from the line. As much as 75 percent of the commercial wastepaper collected in New York City is exported overseas – much of the rest goes to domestic mills like Visy Paper in Staten Island (for conversion to 100% recycled linerboard) and Marcal in New Jersey (for conversion to recycled tissue paper). The following sections highlight the processes used by three area paper recyclers.

#### 3.1 Five Star Recycling, Brooklyn, NY<sup>31</sup>

Formerly known as Rapid Recycling, Five Star is located in an industrial area near Greenpoint in Brooklyn. It is a family owned business limited to paper recycling. It processes approximately 100,000 tons per year of wastepaper. The high grade office paper – which accounts for roughly 25 percent of all paper collected or brought to Five Star – is delivered to the Marcal tissue paper plant in Elmwood Park, New Jersey. All other wastepaper is sorted, baled, and sold to paper brokers, which usually sell the material to recyclers in Asia. According to Five Star, as much as 90 percent of these actual recyclers of paper are located in China. A small portion of the paper processed at Five Star is sold to Visy Paper in Staten Island.

Eighty five to ninety percent of Five Star's wastepaper is trucked in from commercial sources. The rest comes from NYC DSNY, with whom Five Star has a contract. Five Star's processing is very low-tech and commercial and residential

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<sup>30</sup> Personal communication, Taylor Pine, Five Star Recycling, Brooklyn, NY

<sup>31</sup> All of the information about Five Star comes from observations during a site visit and from conversations with Taylor Pine, recycling manager at Five Star.

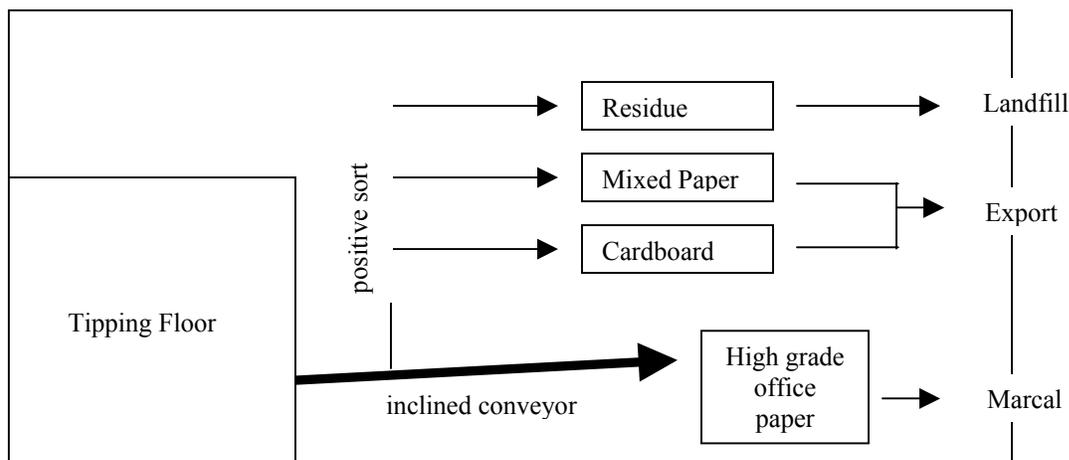
papers are handled slightly differently, as described below. The Five Star operation is similar to most other paper “recyclers” in the New York area.

### 3.1.2. Recycling of commercial wastepaper at Five Star

Commercial wastepaper is often delivered to Five Star mixed in with about 30 percent “black bag” garbage. This is common with commercial loads picked up from office buildings, where approximately 70 percent of the total waste is paper. Large office buildings usually separate their wastepaper, but it is often collected by carters in the same truck as the regular, black bag waste.

The trucks drop their office waste on a tipping floor. Commercial wastepaper is dumped in a designated area, where it is then loaded onto an inclined conveyor belt. The workers are lined along the belt and positively pull out cardboard, newspaper, garbage, and mixed paper. What remains is high-grade white paper, which is baled and shipped to Marcal. .

**Figure 2 Schematic of Five Star Recycling’s commercial wastepaper operation**



The cardboard is baled and sold to brokers, who in turn sell the bales to Chinese mills. The same is true of mixed paper. Non-recyclable residues – as much as 30 percent of incoming loads – are sent to landfills in Ohio, West Virginia, and Pennsylvania. This is done at a relatively low cost by backloading trucks that have brought in to New York finished goods shipped by manufacturers in the Midwest.

### 3.1.3. Recycling of Residential Paper at Five Star

At Five Star there is also a designated tipping area for the paper stream collected by DSNY trucks. The materials dumped by the trucks are loaded onto another inclined conveyor belt. Workers separate the trash (usually about 5 percent), which is sent to landfills. They also positively sort kraft paper and old newspaper, both of which are baled and sent overseas. What remains on the belt is mixed wastepaper. It is baled and shipped overseas, except for the small fraction that goes to Visy Paper.

## 3.2 Chambers Paper Fibers, Brooklyn, NY

Chambers has been owned by the same family since it was founded in 1896. It moved to its current main location under the Manhattan Bridge in Brooklyn in the 1940s and until the 1980s, their only business was paper. Economics made it necessary to expand to garbage collection at that time – customers no longer wanted to have to deal with two different carters, so Chambers was forced to get into the garbage side of the collection business.

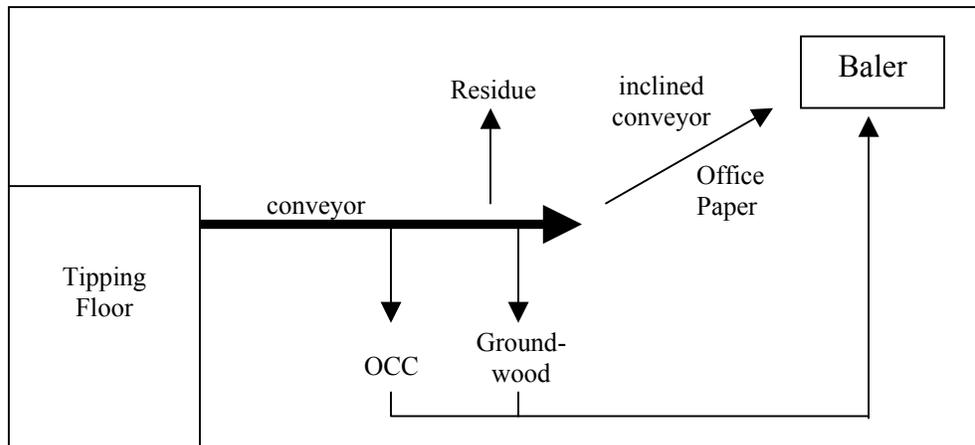
Of the three recycling plants visited for this study, Chambers was the least technologically developed. The operation is very simple, and has been performed more or less the same way for many years. The process varies slightly depending on the source of the paper, which comes in one of two streams: sorted office and mixed paper.

### 3.2.2. Chambers Recycling Process

Office paper is brought in by truck and dumped on the tipping floor. It is then deposited by a front end loader to a horizontal conveyor belt, at floor level, where 6-7 line workers positively sort out cardboard and newspapers. The high grade office paper left on the belt continues up an inclined conveyor belt and is fed into a baling machine. The bales are stored in the back of the building to await shipment. Roughly

80 percent of this paper is bought by overseas mills. The rest is bought by domestic paper mills such as Visy and Marcal<sup>32</sup>.

**Figure 3 Schematic of Chambers paper sorting process**



Mixed wastepaper is processed using the same equipment. The waste usually comes in bags, which are torn open on the tip floor and loaded onto the conveyor. Plastic and other assorted residues are positively sorted and discarded. Cardboard is also positively sorted and baled for sale to mills. The remaining material – paper of various grades – is baled and sold as mixed paper. The facility sorts approximately 10-15 tph of wastepaper.

### 3.3 Sprint Recycling, Jersey City, NJ<sup>33</sup>

Sprint Recycling has two plants, both in New Jersey. One is in Newark, and was recently purchased from Waste Management. It is one of the most state-of-the-art recycling facilities, using sorting technology developed by Bollegraaf, a leading manufacturer of recycling systems. Though it was not possible to visit the Newark plant for this study, the company has a website with a brief description of the technology, called *Paperstar*. This machine “*sorts on size, weight, and stiffness of the material. The inflexible cardboard is simply and effectively separated from newspapers and magazines. Only the smallest pieces of cardboard still need to be*

<sup>32</sup> David Benedetto, private communication, 2004.

<sup>33</sup> All information about Sprint comes from site visits with Jeff, and numerous conversations with Maite Quinn, an executive at Sprint’s main office on the West Side of Manhattan

*sorted manually... After the material has passed through the PaperStar, only a very small number of people will be needed to do further manual sorting”.*<sup>34</sup>

A site visit was made to the second Sprint Recycling plant, in Jersey City. The process there is similar to those used at Chambers and Five Star. The main difference is that the Sprint’s Jersey City facility has a lot more space, a luxury that is difficult to find in the five boroughs. This allows for a longer sorting line, with greater ability to sort larger quantities of material quickly.

There are two main streams of paper processed at Sprint – the curbside collection by DSNY and office paper, collected by private carters. Both streams use the same machinery, but at different times. The Jersey City facility sorts roughly 15 tons per hour, or approximately 72,000 tpy; the Newark facility averages over 25 tph, but can reach rates as high as 40 tph.<sup>35</sup>

### 3.3.2 Sprint Recycling Process

Trucks are weighed on a scale on their way into the facility and then dump their load on the tipping floor. Paper is then picked up using a Bobcat loader with a claw attachment that grabs a large quantity of material at a time and feeds it to an inclined conveyor belt. The material travels up to an elevated horizontal conveyor belt, approximately 40 feet long. For the DSNY curbside loads, there are usually seven workers on either side of the belt, who positively sort out cardboard or trash. The positively-sorted materials are dropped through chutes to two collection bays below the elevated line, from which the cardboard is baled and sold, while the trash is sent to landfills. Mixed paper is left on the belt as a negative sort, and is then also baled and sold. The sorting of office paper loads is done at different periods using the same equipment but usually requires twelve line workers. It is important to Sprint to sort this material as efficiently and accurately as possible, as it yields higher grade paper. Material is loaded onto the conveyor, where workers positively sort mixed paper, cardboard, newspaper, and trash (sent to landfills). High grade white office paper is negatively sorted, falling into the final chute at the end of the conveyor line. All

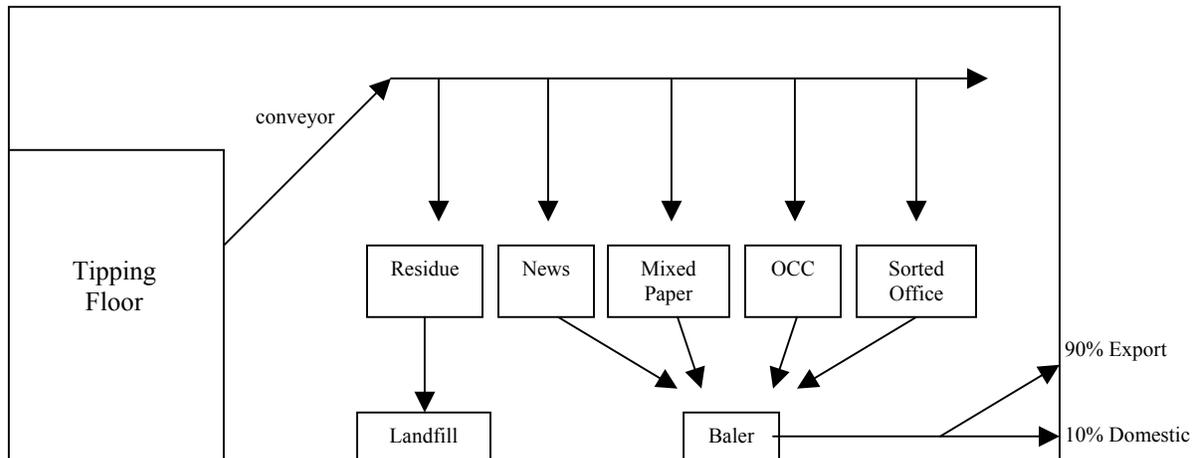
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<sup>34</sup> [http://www.bollegraaf.com/sorting\\_systems\\_paperstar.htm](http://www.bollegraaf.com/sorting_systems_paperstar.htm)

<sup>35</sup> Sprint, site visit, 2004.

materials are baled separately and sold. Currently, Sprint sells approximately 90 percent of its paper to overseas mills.

**Figure 4 Schematic of sorting process of office paper at Sprint Recycling Jersey City Facility**



#### **4. The Visy Paper operation of Pratt Industries (Staten Island, NY)**

##### **4.1 Visy Paper, Staten Island, NY**

Pratt Industries – the parent company of Visy Paper – was started in Melbourne, Australia, in 1948 by Richard Pratt. Over the years it has grown from a local producer of boxes to an 8000-employee, multinational company with \$2.8 billion in annual revenues. While still headquartered in Australia (and still family-owned), its factories are also scattered throughout New Zealand and the U.S. Pratt Industries is comprised of several divisions, including Collection (Visy Recycling), Corrugating (Jet Corr), and an advertising display business (Visy Displays).<sup>36</sup>

Visy Paper is one of these divisions. It is the actual paper producing arm of the Pratt conglomerate. Visy Paper has two mills in the United States – one in Conyers, GA and the other in Staten Island, NY. Both of these plants produce 100 percent recycled content paperboard from municipal paper waste. This section will focus on the Staten Island Plant.

Visy Staten Island was built on the brownfield site of a former Con Edison power plant and is adjacent to the Fresh Kills Landfill. It came online in 1998, and its one line has a processing capacity of 400,000 tons per year of waste paper, though they are

<sup>36</sup> Pratt website, [www.prattindustries.com](http://www.prattindustries.com)

currently handling 360,000 tons per year.<sup>37</sup> As stated earlier, 160,000 of these tons are supplied by DSNY. Visy pays a fee for this material, usually about \$15 per ton.<sup>38</sup> 130,000 tons of the DSNY paper is delivered to the plant by barge from the 59<sup>th</sup> Street Marine Transfer Station in Manhattan. Additionally, 50,000 privately collected (commercial) tons are delivered by barge. The remaining 180,000 tons are trucked in by DSNY and by private businesses and other municipalities. Visy has an aggressive paper supply department, consisting of a manager and four full-time sales associates, all of whom doggedly pursue the waste paper of various communities and companies. Depending upon the size and quality of this material, Visy is either paid by their paper sources (for collection and associated costs), or purchases the paper from them.<sup>39</sup>

#### 4.2 Visy's Effect on the New York City Paper Recycling Industry

Among the many people interviewed during this study, there was almost unanimous praise of Visy's effect on the paper recycling industry in New York City. Visy's consistent need for wastepaper to produce its products has tightened the supply of paper and raised the prices that recyclers receive for their wastepaper. The only drawback noted by recyclers on more than one occasion is the fact that Visy accepts some paper from carters that used to be tipped at sorting facilities, thereby marginally reducing their revenues.

Visy's ability to use (and pay for) lower grades of paper in its process has similarly helped stabilize the market for wastepaper. Some recyclers lament Visy's use of non-mixed paper to create linerboard, a topic that will be discussed later in this report. Overall, however, Visy's presence in the city has helped usher in a new era of legitimacy for the recycling industry, a fact that is appreciated by suppliers and competitors alike.

#### 4.3 The Visy Paper Recycling process<sup>40</sup>

Visy uses a paper machine manufactured by the German company Voith. The process begins as raw materials are dumped at an indoor receiving area. At this early

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<sup>37</sup> Personal communication, Judy Goodstein, Visy Recycling Manager

<sup>38</sup> Conversations with Visy and other industry experts have led me to believe that they pay about \$15/ton, but has not been definitively confirmed.

<sup>39</sup> Personal communication, Judy Goodstein, Visy Recycling Manager

<sup>40</sup> The following process description comes notes taken during my site visit to Visy in April, 2003 and the accompanying personal communication with Mumeer Ahmad, Chief Engineer at Visy Staten Island

stage, there is a rudimentary “screening” procedure, wherein large contaminants are removed and discarded.<sup>41</sup> Aside from the simple screening, the material goes in *as tipped*, meaning there is no pre-processing. The paper is then fed into a large vat called a pulper, where it is mixed with water at 130° F.

In this initial pulping stage, paper and water are blended together until the pulp mix is about 84 percent water and 16 percent solids. The solid fraction now consists of various sizes of paper fibers, which are then separated by size in a process known as fractionation. Different fiber sizes produce different products (e.g., larger fibers are used to produce a heavier grade of paperboard).

From here, the slurry goes through a centrifugal cleaner. Heavy, unwanted materials such as paper clips and staples are spun out and discarded at the bottom of the centrifuge, while the lighter fibrous pulp mix flows through an outlet at the top. A retention-aiding polymer is then added to help hold onto the fiber through the rest of the process. Next, the pulp enters a dispersion tank, where it is heated up in order to melt unwanted organic materials such as glue and wax. The pulp is then sent through a refiner, where the fibers pass between rotating plates in order to “stretch them out” and increase flexibility. At this stage, an industry standard chemical drainage aid is incorporated into the mix. This helps get the pulp down from an 84-to-16 water to solids ratio to a roughly 50-50 percent consistency. Brown dye is also added, giving the mixture its familiar “grocery bag” color.

The process continues with the liquid pulp being injected between moving belts. It is here that the water-fiber slurry begins to resemble a “sheet” of paper, its fibers joining together to form a web. More water is removed as the moving sheet passes through a series of vacuums, presses, and steam heat dryers. Starch is added to increase strength, and the now-continuous sheet passes through a final series of dryers, where it reaches its ultimate moisture content of 7.5 to 8.5 percent. The sheet is wound around a spool into giant rolls weighing about 25 tons each. Later, these rolls are cut to various product sizes and stored in the warehouse onsite. Eventually, they are shipped by truck to Visy’s Georgia cardboard box plant, where they are used as the liner sheets to form

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<sup>41</sup> According to Visy, DSNY material is notoriously “dirty,” sometimes containing such unwanted objects as refrigerators and car doors.

corrugated cardboard and cardboard boxes. This linerboard provides strength, and gives the boxes their recognizable smooth, brown appearance.

Figure 5, below, shows a picture of a Voith paper machine in Japan similar to that used at Visy's Staten Island Plant.<sup>42</sup>

**Figure 5 Voith Paper machine in Japan, similar to Visy**



#### 4.4 Visy Environmental Performance

One cannot argue with the success of Visy's model – the company came into New York; built the first new manufacturing plant in the City since 1948<sup>43</sup> – did it *on a brownfield site*; and diverts paper that would otherwise be exported at great expense or landfilled. Amazingly, while others were *charging* DSNY to take away the paper it collected, Visy was the first to come forth and offer to pay for it.<sup>44</sup> The company continues to press for innovative solutions to environmental problems. There are, however, some aspects of its operation that could be improved further.

##### 4.4.2 Use of the Visy Paper process residues to generate energy

<sup>42</sup> [http://www.pulpandpaper-technology.com/projects/papermills\\_gallery.html](http://www.pulpandpaper-technology.com/projects/papermills_gallery.html)

<sup>43</sup> [www.visy.com/au](http://www.visy.com/au)

<sup>44</sup> Personal communication, Daryl Whitehead, General Manager, Visy Paper

<sup>45</sup> US Department of Energy  
[http://www.netl.doe.gov/publications/proceedings/01/hybrids/Barboza\\_Fresh%20Kills%20Landfill\\_LFGAS.pdf](http://www.netl.doe.gov/publications/proceedings/01/hybrids/Barboza_Fresh%20Kills%20Landfill_LFGAS.pdf)

Visy has been trying for several years to get local politicians to approve a permit for an onsite waste-to-energy plant. Up to 20% of the feedstock delivered to Visy consists of mixed plastics and paper that are rejected during the pulping process.<sup>46</sup> Currently, this material is collected and sent out of state to landfills, at great cost both to Visy and the environment.<sup>47</sup> Instead of shipping this waste and incurring the associated costs, Visy could build an industrial boiler that would use the rejects as fuel since they have a heating value of 7000 Btu/lb<sup>48</sup>, i.e. an annual heat generation potential of about 840 billion Btu. Since the current fuel use at Visy Paper is 1845 billion Btu per year, the use of the residue as fuel would decrease fossil fuel consumption at the plant by 46 percent.<sup>49</sup>

In order to realize such an operation, Visy and visionary government and environmental leaders need to examine the ecological and economic advantages of such an installation and help overcome public misconceptions about the use of waste-to-energy technologies. The Earth Engineering Center of Columbia University is actively involved in combustion technology and waste to energy research, and could be of help to Visy Paper in realizing this goal.

#### 4.5 The potential for further advances in Visy Paper technology

It is an advantage – from a processing point of view – not to have to sort paper into different grades. It cuts down on time and labor costs, which are significant considerations in the highly competitive paper industry. New York, however – because of its dense clusters of office buildings and institutions, as well as its population of avid newspaper readers – contains a vast supply of *high grade* paper waste as well as newsprint.

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<sup>46</sup> Personal communication, Daryl Whitehead, General Manager, Visy Paper

<sup>47</sup> Aside from the aforementioned methane emissions, shipping of waste to landfills out of state is almost invariably done by truck, which also contributes significantly to emissions

<sup>48</sup> Personal communication, Muneer Ahmad, Chief Chemical Engineer, Visy Paper

<sup>49</sup> Personal communication, Daryl Whitehead, General Manager, Visy Paper

**Table 13 June 2004 NYC Recovered Paper Prices**

<b>Post Consumer Paper Type</b>	<b>Price, \$/ton</b>
#6 News (curbside newspapers, mixed paper)	60
#8 News (unsold newspapers)	85
High grade office	110
Computer	200

Sorting of higher grade equates to higher selling prices, and a potential source of great revenue for the cash-strapped city. At the present time, however, the City collects all of this material together and sells it as mixed loose paper. This grade of waste paper is significantly less valuable than, for example, old newspapers (ONP) which are collected separately and baled.<sup>50</sup> Visy has expressed an interest in expanding their capacity and adding a de-inking plant to produce high quality office paper in a second line.<sup>51</sup> Based on the composition of the incoming waste, recycled newsprint could also be efficiently produced.<sup>52</sup>

The composition of Visy’s incoming mixed paper waste is estimated to contain about 40 percent of newspaper, or 144,000 tons per year.<sup>53</sup> If this were to be collected separately or sorted, and then de-inked and manufactured into recycled pulp, Visy could

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<sup>50</sup> This is due primarily to the relative ease of de-inking old newspapers. Newspaper ink does not adhere to the fibers of newsprint, thus making it easy to simply “wash off” the ink from old newspapers and reprocess the fibers into recycled newsprint. Sorted office paper (SOP) is worth even more, due to the strength of its fibers. Though it is highly desirable on the waste paper market, it is more difficult to de-ink. This is because most office paper comes from copiers and laser/ink computer printers, all of which “burn” plastic-based inks directly onto the fibers. Technology to efficiently de-ink these papers exists, but it is energy intensive. Alternatives are being developed but are not yet widely used.

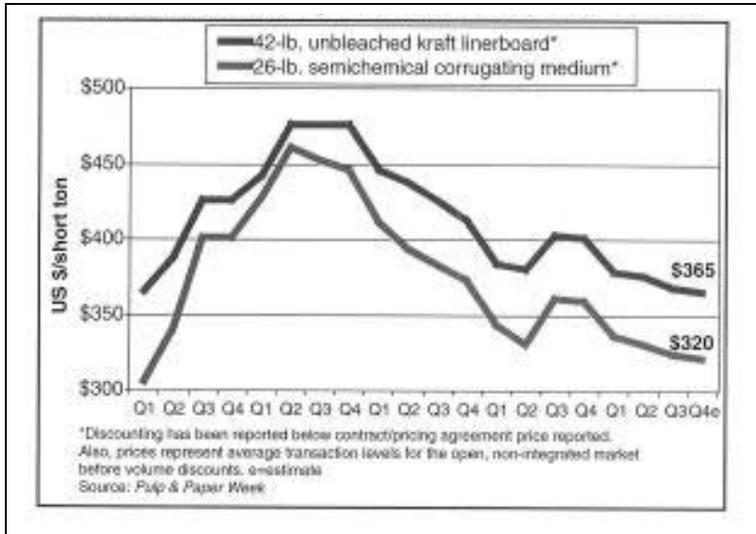
<sup>51</sup> Personal communication, Daryl Whitehead, former General Manager, Visy Paper

<sup>52</sup> Allen Hershkowitz, a senior scientist at NRDC, had a similar idea. He tried to start his own recycled newsprint factory in the Bronx. His book “Bronx Ecology” tells the story of this ill-fated but visionary enterprise. “Tilting at Mills,” by Lis Harris portrays the same story from an outsider’s perspective.

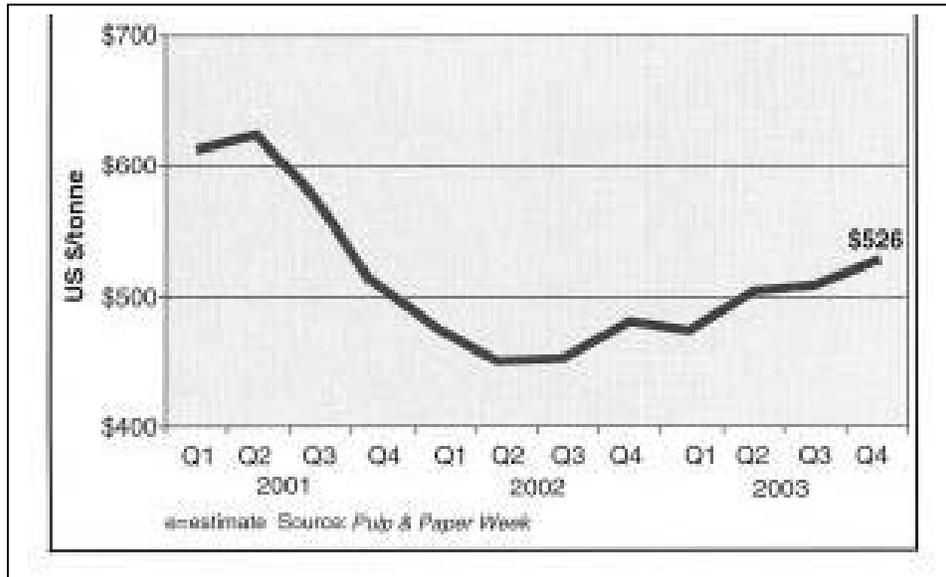
<sup>53</sup> Personal communication, Judy Goodstein, Recycling Manager, Visy Paper

produce approximately 115,000 tons per year of 100 percent recycled newsprint.<sup>54</sup> To put this in perspective, *The New York Times* uses about 300,000 tons per year of newsprint.<sup>55</sup> As one of many newspapers in the city (other major newspapers are *The Wall Street Journal*, *The Daily News*, *The New York Post*, *The New York Sun*, and *New York Newsday*), the market demand for newsprint in New York is large and constant.

**Figure 6 Historical Prices per ton linerboard 1999 to 2003**



**Figure 7 Two year prices per ton newsprint**



<sup>54</sup> Allowing for a 20 percent loss of fibers during the deinking and recycling processes

<sup>55</sup> <http://www.cna-acj.ca>

As shown in figures 6 and 7, newsprint paper sells for at least \$150 more per ton than linerboard<sup>56</sup>. If a company such as Visy could produce a cost competitive, recycled content product, they would have a ready supply of customers for the foreseeable future,<sup>57</sup> as well as the potential for greater profits using the raw materials they already collect.<sup>58</sup>

To accomplish these changes, Visy would have to operate a MRF – something they have expressed interest in doing recently<sup>59</sup>. Paper would be sorted into three grades – mixed, news, and high grade office – before being processed. Visy could agree to sell a percentage of their newsprint to local papers, thereby increasing the tax base of New York City government. In exchange, DSNY could furnish Visy with higher tonnages of its curbside wastepaper.

#### 4.6 Potential for increasing public awareness of Visy Paper and paper recycling

As the concept of sustainability has moved further into the mainstream, the idea of local production of goods and services has gained popularity as well.<sup>60</sup> Visy could substantially affect recycling participation rates by increasing their exposure to residents of the City.

##### 4.6.2 Partnerships with Storefront Businesses Selling Paper Products

One idea Visy may consider is to open a retail store selling finished Visy Board (the branch of the company responsible for manufacturing the finished products from recycled paperboard) paper products manufactured with raw materials from New York City. This could perhaps be accomplished by partnering with retail stores, such as the UPS Store, that sell various shipping related items (primarily cardboard boxes). Customers could be invited to bring in wastepaper in exchange for a small percentage

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<sup>56</sup> 2002 Pulp and Paper Factbook

<sup>57</sup> *The Times* was a member of a group of newspaper publishers called “The Northeast Newspaper Task Force,” in the late 1990’s. Their goal was to increase the recycled content of newsprint in northeastern states to at least 30 percent by 2001. All members – including *The Times* – signed off on this stated goal but, to date, *The Times* has not met the requirement. This could be due to several factors, the most notable being the lack of supply.

<sup>58</sup> Sorting and processing would have an effect on this profit

<sup>59</sup> Visy contemplated a response to the DSNY RFP to sort, process, and market recyclables

<sup>60</sup> <http://www.coopamerica.org/individual/marketplace/IMBSTT02.HTM>

discount on purchases. This might encourage the type of informal “industry” that has evolved around redeemable bottles, whereby people take deposit-eligible plastic and glass containers out of the trash and redeem them for cash. A corollary benefit of a storefront would be the increased public image that such an enterprise would create for Visy Paper.

#### 4.6.3 Home delivery services

Visy Paper is a natural partner for Internet-based home delivery services which are extremely popular in New York City, such as Amazon.com and FreshDirect. These services use corrugated containers to ship their goods to apartments throughout NYC. In addition to a possible business match for the Visy Board division of Pratt Industries, DOS, Visy, and these companies could advertise paper recycling on the packaging. This would be particularly useful in the case of FreshDirect, which currently operates only in New York City.

### **5. Increasing paper recycling in New York City**

There have been many suggestions, studies, and pilot programs over the years in the waste management industry intended to increase rates of recycling. These ideas and discussions are usually centered on government-run recycling programs. In New York City, this is most certainly the case, and the necessity of improving DSNY recycling rates is evidenced by the far greater success commercial paper recyclers have attained – with or without mandatory laws.

#### 5.1 Improving Residential Paper Recycling in New York City

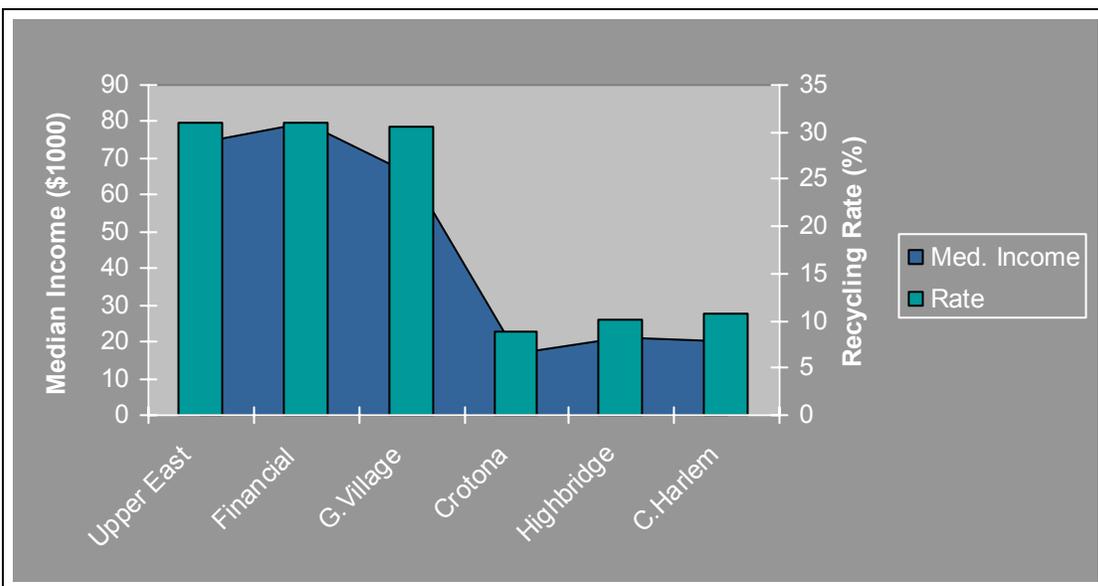
As noted earlier, the DSNY curbside collection captures only 29% percent of paper – far less than the estimated 69 percent commercial recycling rate. The first and most obvious reason for this difference is that there is a financial incentive for commercial establishments and haulers to recycle paper: It has *value*, which either saves money (for

the business disposing the paper) or makes money (for the haulers and recyclers collecting and selling it).

Residential “customers,” on the other hand, have little motivation outside of personal environmental awareness to set aside their wastepaper – DSNY collects all waste coming from households and nonprofit institutions, regardless of how much or little is produced. While the money for this service comes from taxpayers, few New Yorkers are likely to “invest” in future lower taxes by recycling more.

This fact is made clear by considering the residential recycling rates (for all materials) by borough. Figure 2 shows the three highest and lowest recycling rates by neighborhood in New York City, and their associated median household incomes. The graph indicates that higher income communities recycle significantly more than lower income communities. It would appear, therefore, that people in higher income brackets in New York feel more invested in their society, probably because they enjoy better treatment in general and want to perpetuate that status. Environmentalism, then, can be seen through a different lens – less an act of self-sacrifice than one of self-perpetuation, or reinforcement of the comfortable status quo.

**Figure 8 NYC Highest and lowest recycling rates by neighborhood and median household income**



### 5.1.2 The RecycleBank method

The solution, then, is either to help people in the poorer areas of the city feel more invested in society's well being (a task clearly beyond the scope of this report), or to find ways to provide incentives for increasing recycling by more citizens. This idea has been introduced recently by a new business called RecycleBank<sup>61</sup>. They have proposed to partner with retail corporations that like to invest in environmental programs and reward people based on how much they recycle. This will be accomplished using a mix of technology and economic incentives to residents. Residents will be provided with bins with embedded computer chips. Collection vehicles will be retrofitted with automated devices that scan the chips, weigh the bins to determine the amount of material recycled by that particular household, and record this information by customer in an on-board database. RecycleBank will partner with local and national businesses to provide coupons for recyclers based on how much they recycle.

RecycleBank will be conducting a pilot program in Philadelphia in early September, and it is worth watching to see if their strategy will result in a marked increase in residential recycling. Targeted neighborhoods in Philadelphia are very similar to many neighborhoods in Staten Island – single family homes with City-run, curbside collection. Visy Paper may want to consider a pilot program in Staten Island using Recyclebank's methodology and technology.

### 5.2 NYC-Visy Paper collaborative effort to increase residential recycling of paper

Despite the apparent difficulties in capturing residential recyclables, New York City has a great opportunity to increase the diversion of paper because it already has a very successful recycler, Visy Paper, in Staten Island. As noted earlier, in contrast to most other collected paper that is transported to other countries and states for recycling, Visy processes nearly 389,000 tons of recycled paper annually right in NYC, and is prepared to build a second paper line – if it can secure additional supplies of feedstock.

It would be advisable, then, for DSNY and other interested government bodies to collaborate with Visy Paper in a campaign to increase the residential rate of paper

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<sup>61</sup> [www.recyclebank.com](http://www.recyclebank.com)

recycling beyond the present level of 29%, and make the additional paper collected available to Visy. Visy would fund an advertising campaign by advising all NYC residents that by separating every non-contaminated shred of paper they would help their City reduce landfilling fees, advance environmental goals for natural resource conservation, and encourage the creation of additional jobs and economic development in one of the boroughs. This would also help Visy increase their level of exposure throughout the city and especially in Staten Island. EEC research has shown that many NYC residents are surprised to learn that there is a local recycling plant – indeed, some people are convinced that the paper they so diligently set aside is actually *thrown away* with the rest of the trash.<sup>62</sup> A simple awareness of Visy Paper’s presence and contribution to the nascent recycling infrastructure of New York City would likely serve to increase residential participation significantly.

### 5.3 Consistency in NYC recycling programs

New York City needs to maintain consistency in the recycling program. Studies have shown that residents often feel confused by the relatively frequent changes in the City’s recycling rules<sup>63</sup>. The 2002 suspension of glass and plastic collection contributed to this confusion, and paper recycling rates suffered as a result.<sup>64</sup> For recycling to work, there needs to be a clear, long term commitment from City government and the Department of Sanitation..

### 5.4 Single Stream Recycling

In New York City, 22 out of 59 sanitation districts use dual bin collection trucks<sup>65</sup> to collect recyclables – one bin (or compartment) is used for paper, the other for MGP. The remaining 37 districts use three separate trucks to collect residential waste – one for paper recyclables, one for MGP recyclables, and one for black bag waste.<sup>66</sup> Dual bin collections are the most recent upgrade to the NYC recycling system, and as such are more efficient than using separate trucks for each waste/recycling stream. These upgrades, however,

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<sup>62</sup> We have found this to be the case from interviews with many residents of the city.

<sup>63</sup> *DSNY Market Research on Recycling in New York City*

<sup>64</sup> NYC DSNY *Request for Proposals to Accept, Process, and Market New York City’s Recyclables*. 7/03.

<sup>65</sup> [http://www.nyc.gov/html/dos/pdf/mmr/dsny0902\\_mmr.pdf](http://www.nyc.gov/html/dos/pdf/mmr/dsny0902_mmr.pdf)

<sup>66</sup> Personal communication, DSNY

were made before single stream recycling was logistically and/or economically feasible.

Single stream recycling (SSR), whereby all recyclables are placed in a bin together and collected in a single compartment truck, is gaining in popularity through the U.S. Municipalities are particularly excited about the program due to the decrease in collection costs, as trucks with a single compartment for all recyclables fill up faster than dual bin or two-truck systems. This would likely be the case in New York City, where paper recycling tends to outpace MGP recycling, thus resulting in the paper bin on the dual-bin DSNY trucks filling before the MGP compartment. Dual-bin trucks then have to go to the MRF to unload the filled compartment while the second is partly empty. In New York, collection costs of the black bags (“garbage”) have been reported to be \$66 per ton<sup>67</sup> and \$106 per ton for MGP and paper recycling. Single stream would reduce this cost of the recycling collection significantly, and has been shown to increase the overall recycling rate in places where it has been implemented by 1-5 percent.<sup>68</sup>

A 2002 report written by EEC’s Claire Todd estimated the cost to New York City of building an 876,000 tpy single stream recycling facility would \$69 per annual ton.<sup>69</sup> Operating, collection, leasing, and other expenses would bring the per ton costs to \$110.<sup>70</sup> It would be worthwhile for DSNY and DEC to consider partnering with Visy Paper and other area recyclers to make such a facility a reality in NYC.

## **6. Increasing the rate of Paper Recycling: The International picture**

The commercial paper recycling industry is well-established and after 100 years of practice, it manages to capture 69 percent of the wastepaper generated by New York businesses. To determine whether or not improvement is possible, it is useful to look at the most successful countries in the world at recycling paper.

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<sup>67</sup> NYC Comptroller report to City Council, May 2003.

[http://www.comptroller.nyc.gov/bureaus/opm/reports/Recycling\\_Cost\\_Projections\\_for\\_City\\_Council\\_REPORT.pdf](http://www.comptroller.nyc.gov/bureaus/opm/reports/Recycling_Cost_Projections_for_City_Council_REPORT.pdf)

<sup>68</sup> Eureka Recycling. There has been some concern among recyclers that the quality of paper in SSR systems is lesser than in dual collection systems. This would probably not be an issue for Visy paper, where the technology exists to deal with “dirty” paper, but it may have an adverse affect on prices brokers are willing to pay for paper from other recyclers.

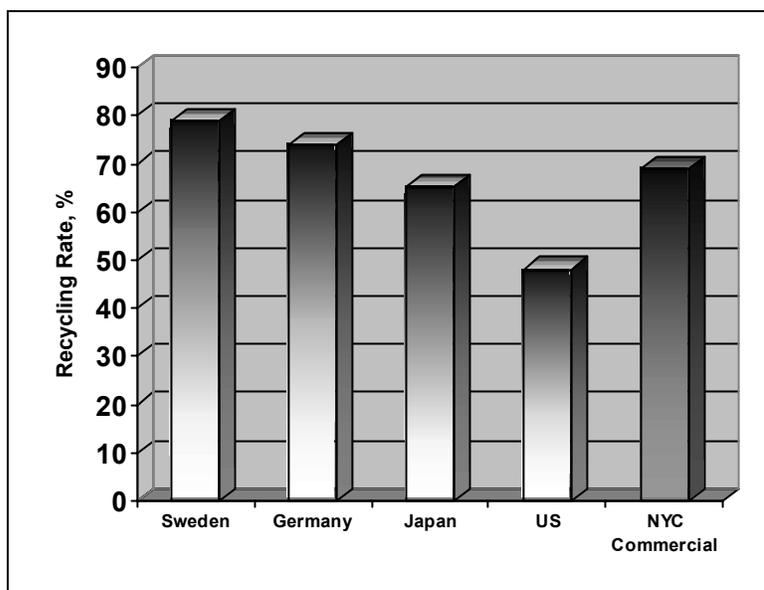
<sup>69</sup> <http://www.seas.columbia.edu/earth/toddthesis.pdf>

<sup>70</sup> This does factor in revenues from processed recyclables

## 6.1 Worldwide Paper Recycling Rates<sup>71</sup>

The highest paper recycling rate in the world has been achieved by Sweden, at 79 percent. The recycling rate in Germany is 74 percent, Finland 72 percent, and Japan about 65 percent. The United States, for comparison, has a 48.1 percent paper recycling rate. It is clear, therefore, that although there is room for further improvement in the overall rate of paper recycling, the U.S. commercial paper recycling industry fares very well (69 percent recycling rate) with respect to the rest of the developed world (Figure 9).

**Figure 9 US Paper recycling rate and NYC commercial recycling rate in relation to other countries' overall paper recycling rates**



## 7. The Benefits and Drawbacks of Export

As noted earlier, export accounts for at least 75 percent of all collected wastepaper in New York City. The growth of export markets has in many ways had a beneficial effect similar to Visy's appearance in the 1990's – it has served to tighten the market and increase demand for wastepaper. However, there are some important reasons to consider whether or not the export of used paper should be encouraged as a long term option for city recyclers.

<sup>71</sup> <http://www.paperchain2000.org.uk/facts/euro.htm>

A Carnegie Mellon study on emissions from cargo ships<sup>72</sup> shows that “international ship emissions represent more than 14 percent of nitrogen emissions from global fuel combustion sources and over 16 percent of sulfur emissions from world petroleum use.” Additional reports have voiced similar concerns. A recent editorial in the *New York Times* by Russell Long – a former shipping executive and current director of Bluewater Network, an environmental group – stated that today’s large cargo ships “can release as much pollution in one hour as 350,000 current model-year cars.”<sup>73</sup> This is largely due to the ships’ use of very low-grade fuels, and the lack of internationally recognized environmental regulations. Until marine freight falls under the same tight controls as land-based transport, it may be wise to reconsider a complete devotion to waste export.

Any scaling back of waste exports would have to occur on a policy level, however, as recyclers are (rightly) focused on surviving in a very difficult business environment. If government were to step in, there would be two clear choices: the first, to apply strict environmental standards to ocean-going vessels; the second, to regulate the export of waste. The latter scenario is unlikely, as the trend towards increasing world trade continues unabated.

Exporting wastepaper may also present a missed economic opportunity for New York City. When a recycler collects wastepaper from NYC businesses, processes it, and then sells it to Visy Paper, taxes are being collected by the City at all points in the loop: for the initial collection; for the processing of the material (payroll taxes); for the sale of the processed paper to Visy; for Visy’s transformation of the material into a new product (payroll); and for Visy’s sale of the finished product to end users. Much of this revenue is lost for exported paper.

Industries must continue to find a way to balance the economic needs of companies with the environmental needs of society. Recyclers are exporting because foreign mills pay better money for paper. Yet New York City’s waste – especially its paper – amounts to one of its few “natural” resources. There are many benefits to keeping this resource local. It may be up to government to craft solutions that allow recyclers to get competitive prices for the paper they sell while keeping the material here, thus generating

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<sup>72</sup> <http://hdgc.epp.cmu.edu/projects/abstracts/ship-emissions.html>

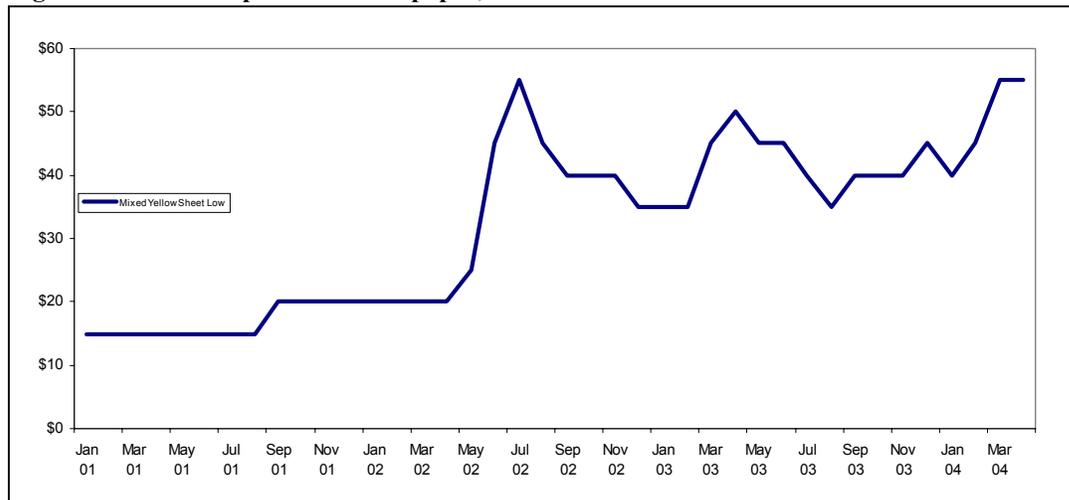
<sup>73</sup> <http://www.mindfully.org/Air/2004/Cargo-Ships-Pollution21feb04.htm>

revenue for local business and sparing the drastic toll on the environment associated with freighters.

## 8. Economics and Market Volatility

Paper recycling, like any business, is at the mercy of the dips and turns of the open market. Mixed paper is an example. According to published prices by Recycling Manager<sup>74</sup>, the price of mixed wastepaper over the past three years has ranged from as low as \$15 per ton to its current high of \$55 per ton. This volatility is reflected in Figure 10.

**Figure 10 Historical price of mixed paper, NYC**



Processing costs at the typical New York City paper recycling facility are of the order of \$35 per ton. When mixed paper drops below those prices, recyclers are forced to either take a loss on it, or charge customers for its collection.<sup>75</sup> Other grades of paper usually fetch higher prices than mixed paper, but follow a similar pattern of ups and downs. It is in this climate that paper recyclers must compete.

<sup>74</sup> <http://www.amm.com>

<sup>75</sup> When paper is commanding decent prices, recycling companies usually pay customers for their paper waste and charge them for their waste.

## 9. Conclusions

The New York City paper recycling industry is vast, complex, and ancient. Commercial paper recyclers have been around for at least 100 years and, without the aid of advanced technology, have managed recycling rates rivaling those of any city in the world. It has survived world wars, the Great Depression, the exodus of manufacturers from the city, and threats from the mafia. Most recently, it seems to have fought off the efforts of large corporations like Waste Management and BFI to flood the market. After all of this, it has still managed to reach a 70 percent recycling rate. Chances are the industry will continue to adapt and survive in New York.

The long term viability of the New York City Department of Sanitation's recycling program, however, has very recently been called into question. When Mayor Bloomberg suspended glass and plastic collections in 2002 – perhaps wisely, as glass and plastic were not being effectively recycled at the time<sup>76</sup> – he inadvertently affected paper recycling as well. Frequent changes to collection methods by DSNY have left New Yorkers confused and, to a great extent, non-compliant.

Switching to single stream collection for its curbside program would probably begin to push the recycling rate back upward. But DSNY and City leaders must make a clear, consistent, and concerted effort to nurture and grow recycling well into the future. Means of increasing recycling rates that were discussed earlier and pilot programs like RecycleBank must be tried – the City has nothing to lose by seeking innovative solutions to a unique environment. Finally – and perhaps most feasibly – Visy must work with city, educational, and nonprofit institutions to increase its exposure in New York. As concepts such as sustainability become more prominent, residents are likely to feel more engaged by programs with clear local implications. Visy must capitalize on this opportunity.

New York City must also work with Visy to help them site a small WTE facility for its rejects. An investment of this kind could serve as a model for increasing the profitability and long term viability of recyclers around the country.

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<sup>76</sup> See *Technical and Economic Analysis of the New York City Recycling System*.

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<sup>77</sup> *Commercial Waste Report*, page 25.

<sup>78</sup> *Commercial Waste Report*, page 26.

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- <sup>79</sup> <http://hdgc.epp.cmu.edu/projects/abstracts/ship-emissions.html>
- <sup>80</sup> <http://www.mindfully.org/Air/2004/Cargo-Ships-Pollution21feb04.htm>
- <sup>81</sup> <http://www.amm.com>
- <sup>82</sup> When paper is commanding decent prices, recycling companies usually pay customers for their paper waste and charge them for their waste.
- <sup>83</sup> See *Technical and Economic Analysis of the New York City Recycling System*.
- <sup>84</sup> Personal communication, Taylor Pine, Five Star Recycling, Brooklyn, NY
- <sup>85</sup> All of the information about Five Star comes from observations during a site visit and from conversations with Taylor Pine, recycling manager at Five Star.
- <sup>86</sup> All information about Sprint comes from site visits with Jeff, and numerous conversations with Maite Quinn, an executive at Sprint's main office on the West Side of Manhattan
- <sup>87</sup> [http://www.bollegraaf.com/sorting\\_systems\\_paperstar.htm](http://www.bollegraaf.com/sorting_systems_paperstar.htm)
- <sup>88</sup> Pratt website, [www.prattindustries.com](http://www.prattindustries.com)
- <sup>89</sup> Personal communication, Judy Goodstein, Visy Recycling Manager
- <sup>90</sup> Conversations with Visy and other industry experts have led me to believe that they pay about \$15/ton, but has not been definitively confirmed.
- <sup>91</sup> Personal communication, Judy Goodstein, Visy Recycling Manager
- <sup>92</sup> The following process description comes notes taken during my site visit to Visy in April, 2003 and the accompanying personal communication with Muneer Ahmad, Chief Engineer at Visy Staten Island
- <sup>93</sup> According to Visy, DSNY material is notoriously "dirty," sometimes containing such unwanted objects as refrigerators and car doors.
- <sup>94</sup> [www.visy.com/au](http://www.visy.com/au)
- <sup>95</sup> Personal communication, Daryl Whitehead, General Manager, Visy Paper
- <sup>96</sup> <http://hypertextbook.com/facts/1999/JessicaHowellONeill.shtml>
- <sup>97</sup> Personal communication, Muneer Ahmad, Visy Paper. Visy reuses approximately half of its daily water intake without treating it.
- <sup>98</sup> North Carolina Department of Environment and Natural Resources, <http://www.enr.state.nc.us/>
- <sup>99</sup> Based on Jackson's treatment of 100,000 gallons per day
- <sup>100</sup> NYC DSNY, [http://www.nyc.gov/html/DSNY/html/fklf/fklf\\_05.html](http://www.nyc.gov/html/DSNY/html/fklf/fklf_05.html)
- <sup>101</sup> Personal communication with Daryl Whitehead, General Manager, Visy Paper. Whitehead claims that Visy spent \$1 million in research and development of a methane-capturing system.
- <sup>102</sup> New York City DSNY, [http://www.nyc.gov/html/DSNY/html/fklf/fklf\\_05.html](http://www.nyc.gov/html/DSNY/html/fklf/fklf_05.html)
- <sup>103</sup> US Department of Energy  
[http://www.netl.doe.gov/publications/proceedings/01/hybrids/Barboza\\_Fresh%20Kills%20Landfill\\_LFGAS.pdf](http://www.netl.doe.gov/publications/proceedings/01/hybrids/Barboza_Fresh%20Kills%20Landfill_LFGAS.pdf)
- <sup>104</sup> U.S. EPA, <http://www.epa.gov/ghginfo/qa/>
- <sup>105</sup> Personal communication, Daryl Whitehead, General Manager, Visy Paper
- <sup>106</sup> Aside from the aforementioned methane emissions, shipping of waste to landfills out of state is almost invariably done by truck, which also contributes significantly to emissions
- <sup>107</sup> Personal communication, Muneer Ahmad, Chief Chemical Engineer, Visy Paper
- <sup>108</sup> Personal communication, Daryl Whitehead, General Manager, Visy Paper
- <sup>109</sup> This is due primarily to the relative ease of de-inking old newspapers. Newspaper ink does not adhere to the fibers of newsprint, thus making it easy to simply "wash off" the ink from old newspapers and reprocess the fibers into recycled newsprint. Sorted office paper (SOP) is worth even more, due to the strength of its fibers. Though it is highly desirable on the waste paper market, it is more difficult to de-ink. This is because most office paper comes from copiers and laser/ink computer printers, all of which "burn" plastic-based inks directly onto the fibers. Technology to efficiently de-ink these papers exists, but it is energy intensive. Alternatives are being developed but are not yet widely used.
- <sup>110</sup> Personal communication, Daryl Whitehead, former General Manager, Visy Paper
- <sup>111</sup> Allen Hershkowitz, a senior scientist at NRDC, had a similar idea. He tried to start his own recycled newsprint factory in the Bronx. His book "Bronx Ecology" tells the story of this ill-fated but visionary enterprise. "Tilting at Mills," by Lis Harris portrays the same story from an outsider's perspective.
- <sup>112</sup> Personal communication, Judy Goodstein, Recycling Manager, Visy Paper
- <sup>113</sup> Allowing for a 20 percent loss of fibers during the deinking and recycling processes
- <sup>114</sup> <http://www.cna-acj.ca>
- <sup>115</sup> 2002 Pulp and Paper Factbook

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<sup>116</sup> *The Times* was a member of a group of newspaper publishers called “The Northeast Newspaper Task Force,” in the late 1990’s. Their goal was to increase the recycled content of newsprint in northeastern states to at least 30 percent by 2001. All members – including *The Times* – signed off on this stated goal but, to date, *The Times* has not met the requirement. This could be due to several factors, the most notable being the lack of supply.

<sup>117</sup> Sorting and processing would have an effect on this profit

<sup>118</sup> [www.recyclebank.com](http://www.recyclebank.com)

<sup>119</sup> We have found this to be the case from interviews with many residents of the city.

<sup>120</sup> *DSNY Market Research on Recycling in New York City*

<sup>121</sup> NYC DSNY *Request for Proposals to Accept, Process, and Market New York City’s Recyclables*. 7/03.

<sup>122</sup> [http://www.nyc.gov/html/dos/pdf/mmr/dsny0902\\_mmr.pdf](http://www.nyc.gov/html/dos/pdf/mmr/dsny0902_mmr.pdf)

<sup>123</sup> Personal communication, DSNY

<sup>124</sup> NYC Comptroller report to City Council, May 2003.

[http://www.comptroller.nyc.gov/bureaus/opm/reports/Recycling\\_Cost\\_Projections\\_for\\_City\\_Council\\_REPORT.pdf](http://www.comptroller.nyc.gov/bureaus/opm/reports/Recycling_Cost_Projections_for_City_Council_REPORT.pdf)

<sup>125</sup> Eureka Recycling. There has been some concern among recyclers that the quality of paper in SSR systems is lesser than in dual collection systems. This would probably not be an issue for Visy paper, where the technology exists to deal with “dirty” paper, but it may have an adverse affect on prices brokers are willing to pay for paper from other recyclers.

<sup>126</sup> <http://www.seas.columbia.edu/earth/toddthesis.pdf>

<sup>127</sup> This does factor in revenues from processed recyclables

<sup>128</sup> <http://www.paperchain2000.org.uk/facts/euro.htm>

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<sup>130</sup> *Commercial Waste Report*, page 26.

<sup>131</sup> <http://hdgc.epp.cmu.edu/projects/abstracts/ship-emissions.html>

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<sup>133</sup> <http://www.amm.com>

<sup>134</sup> When paper is commanding decent prices, recycling companies usually pay customers for their paper waste and charge them for their waste.

<sup>135</sup> See *Technical and Economic Analysis of the New York City Recycling System*.