

January 2012

Looking for Savings:

Has The Switch to Dual-Bin Trucks for Some Recycling Pickups Increased Productivity?

Summary

As IBO has documented in the past, it costs more to collect a ton of recyclables than a ton of regular trash. The main reason for this: although it costs the same amount to run and staff a truck regardless of the material being picked up curbside, a truck on a typical trash route collects a lot more refuse by weight than a truck collecting recyclables.

Seeking to make recycling collection more cost-effective, the city has substantially increased its use of dual-bin trucks, which eliminate the need for sending two trucks on a recycling route, one to pick up paper, the other metal, glass, and plastic. But most recycling processors handle either only paper or only metal, glass, and plastic. That means a dual-bin truck usually has to make two separate stops to dump its load, which translates into additional personnel costs. So has the use of dual-bin trucks increased collection productivity and reduced costs for the city?

We have examined changes in productivity in a total of nine community districts, four of which switched to using dual bin trucks in 2007 and another five were converted in 2009. Among our findings:

- Costs for recycling pickups fell by nearly \$575,000 (13.1 percent of collection costs) among the four districts that switched to dual bin trucks in 2007 and by nearly \$363,000 (9.4 percent) among the five that converted in 2009.
- In both 2007 and 2009, staffing costs decreased. The savings from running a single truck more than offset the additional costs from having to drive the dual-bin trucks to two separate locations to unload.
- Dual bin trucks were about 20 percent more productive—in terms of tonnage collected on each truck run—than rear loaders at collecting paper and metal, glass, and plastic.

The city now uses dual-bin trucks for recycling pickups in more than half of New York's community districts. But the ability to expand the use of dual-bin trucks to more neighborhoods may be limited, especially along routes with many large apartment buildings, where the amount of recycling collected on each truck shift using a rear-loader is already high.

INTRODUCTION

Since the mid-1990s, the city has used dual-bin trucks, instead of rear-loader garbage trucks, to collect recycling in certain community districts. Unlike rear-loaders, which collect only one type of material (either paper or metal, glass, and plastic— sometimes called MGP) during a shift, dual-bin trucks can collect two separate streams of recycling on the same shift. Since both trucks are operated by a two-person crew, the Department of Sanitation (DSNY) expected to reduce the total number of trucks and personnel needed to collect recycling by increasing the use of dual-bin trucks. This policy, which began with the conversion of five community districts in Queens to dual-bin collection in 1997, was expanded incrementally over 12 years. In recent years, DSNY continued the implementation of dual-bin collection in four new districts in 2007 and five districts in 2009. In fiscal year 2010, dual-bin trucks picked up roughly 60 percent of all city curbside recycling tonnage and were used in 31 community districts.¹

There are a few considerations to using dual-bin trucks. First, they cost more than rear-loader trucks and require a greater capital investment, though fewer trucks may be needed. Second, since they have the capacity to collect both paper and MGP on the same route, dual-bin trucks need to be offloaded at two separate locations, frequently

by a single driver on a separate shift from the collection. As the paper and MGP processors the city uses are generally not located near each other, dual-bin trucks often have to be driven greater distances than rear-loader trucks.

In a [March 2004 report](#), IBO concluded that one possible way to make recycling more cost-effective would be to increase collection productivity—in other words, raise the amount of materials picked up on each truck-shift. For this fiscal brief, IBO compared recycling collection in districts before and after dual-bin trucks came into use to determine whether these trucks, with their higher initial cost and frequent need for additional transporting, increased productivity and reduced the cost of collecting recyclables. This report focused on the efficiency of collecting recyclables with dual-bin trucks and did not consider other factors that come into play when considering the overall efficacy of recycling, such as waste export costs and environmental factors.

Putting Dual-Bin Trucks into Use

Dual-bin trucks are used to collect recycling in larger districts where housing is more spread out. The total amount of recycling set out for curbside pickup in these districts can be high, but because of the lower housing density, the amount of recycling collected on an individual truck-shift is lower than in other smaller, more dense districts.

Data and Methodology

IBO received individual records for all sanitation truck collection runs from fiscal year 2006 through 2010 from DSNY. With the goal of assessing changes in collection productivity resulting from implementation of dual-bin trucks, IBO analyzed collection records in four community districts converted in January 2007 (2007 cohort) and five community districts converted in January 2009 (2009 cohort).² IBO compared productivity of recycling collection 12 months before and 12 months after DSNY began using dual-bin trucks in these districts.

This analysis looked only at residential curbside collection, which represents about 85 percent of all tonnage collected by DSNY. Collection from public housing developments, schools, and other institutions is excluded because the process of collecting recyclables at institutions via containerized pickup was not affected by the use of dual-bin trucks.

There are two ways to measure how full a collection truck is: tonnage (weight) and capacity (volume). The relationship between weight and volume of recycling collected depends on the proportion of various materials on the recycling route. Paper picked up for recycling generally weighs more than MGP (assuming a small share of glass and a larger share of light-weight plastics). However, DSNY collections records do not capture capacity, or how full the truck is when it is taken to a recycling processor, only the weight of the materials offloaded is recorded. Since the data needed to factor capacity into our analysis at the truck-shift level were unavailable, IBO measured collection productivity in terms of tons per truck-shift (TPTS).

Collection productivity in a district is calculated by summing all tonnage of recycling collected over a period of time and dividing it by the total number of truck-shifts needed to collect that tonnage.³ A truck-shift is defined as a truck following its scheduled collection routes for eight hours.⁴

Where are Dual-Bin Trucks Used? DSNY began using dual-bin trucks in districts with low housing density, where the housing stock is spread over a greater geographical area (less than 16,000 units per square mile). [See map on [page 4](#).] Dual-bin trucks have been put into service in lower-density districts, where only about 38 percent of residential units are in large buildings with more than 10 units on average. In contrast, in districts that are served predominantly by rear-loader trucks, about 79 percent of units are in located in large buildings.

Although both types of trucks have essentially the same total volume capacity, a dual-bin truck, because it has two compartments, holds a lower volume of each material than a rear-loader. That makes dual-bin trucks more efficient for collecting both types of recyclables at the same time in districts with lower recycling tonnage per truck-shift, even if the districts' total recycling tonnage might be greater. Lower density districts may generate lower recycling tonnage per truck-shift because residents are more spread out so less tonnage is collected on a shift, but may have a higher total district recycling tonnage than districts where housing is denser.

In addition, the two compartments of a dual-bin truck are not equal in size. The larger bin holds about 5.5 tons of paper while the smaller bin holds about 3.5 tons of metal, glass, and plastic (because paper is denser than MGP, these figures do not reflect the relative volumetric capacity of the bins). Because the bin sizes are fixed, dual-bin trucks have higher collection productivity in districts where the ratio of paper to MGP is similar to the ratio of the two bins in the truck, which prevents one bin of the truck from filling up faster than the other.

Districts where recycling is collected by dual-bin trucks have higher overall recycling tonnage, but lower recycling tonnage per square mile. For example, in 2010, an average of 10,454 tons of paper and MGP were collected and diverted from the waste stream in dual-bin districts, about 38 percent more than in rear-loader districts. However, because dual-bin districts are spread over a larger area, these districts' recycling tonnage per square mile is on average 53 percent lower than the average among rear-loader districts.

Comparison of Collection Productivity Before and After Switch to Dual-Bin Trucks. IBO's analysis of nine districts that began using dual-bin trucks in January of 2007 and 2009 found that dual-bin trucks helped improve collection productivity by an average of 1 ton per truck shift. This

	Regular (n=28)	Dual-Bin (n=31)
Average Tons Recycled	7,577	10,454
Average Tonnage per Square Mile	3,332	1,555
Average Share of Units in Large Buildings	79%	38%
Average Share of Units in 1-2 Family Homes	6%	44%
Average Housing Density	30	11

SOURCES: IBO; Department of Sanitation; Department of Finance
 NOTES: All figures are 2010 collection data. Large buildings are defined as those with more than 10 units. Housing density is calculated in thousand units per square mile.

higher productivity, though, was partially offset by the need to empty dual-bin trucks at two different sites because paper and MGP processors are generally not housed at the same location. This results in an increased use of relay hours—when a different sanitation worker drives trucks to offload on a separate shift.

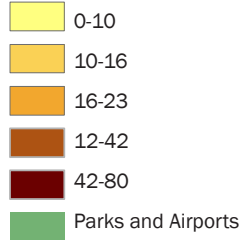
For the 2007 cohort, IBO found that after switching to dual-bin trucks, recycling collection productivity in the four districts increased by 19.3 percent, from 4.98 tons per truck shift to 5.94 tons per truck-shift. Productivity gains varied across districts, with the largest productivity increase of 24.6 percent in Brooklyn Community District 7 (Sunset Park), and the smallest productivity increase 12.5 percent in Bronx Community District 11 (Pelham/Morris Park). Districts with lower productivity prior to the switch saw greater improvements.

In the four districts that switched to dual-bin trucks in 2007, total recycling tonnage declined by 1.5 percent from 39,084 tons to 38,490 tons, in the year following implementation. However, the city needed 17.3 percent fewer truck-shifts to pick up that tonnage. (The decrease in tonnage is consistent with citywide trends, as the citywide recycling tonnage declined by 2.3 percent from 2006 to 2007.) Prior to the conversion, rear-loader trucks picked up 93.1 percent of all recycling, with dual-bin and other types of trucks collecting the remaining tonnage.⁵ Increased use of dual-bin trucks in these districts decreased the share of recycling picked up by rear-loaders to 8.4 percent in 2007, as the share collected by dual-bins grew to 91.6 percent.

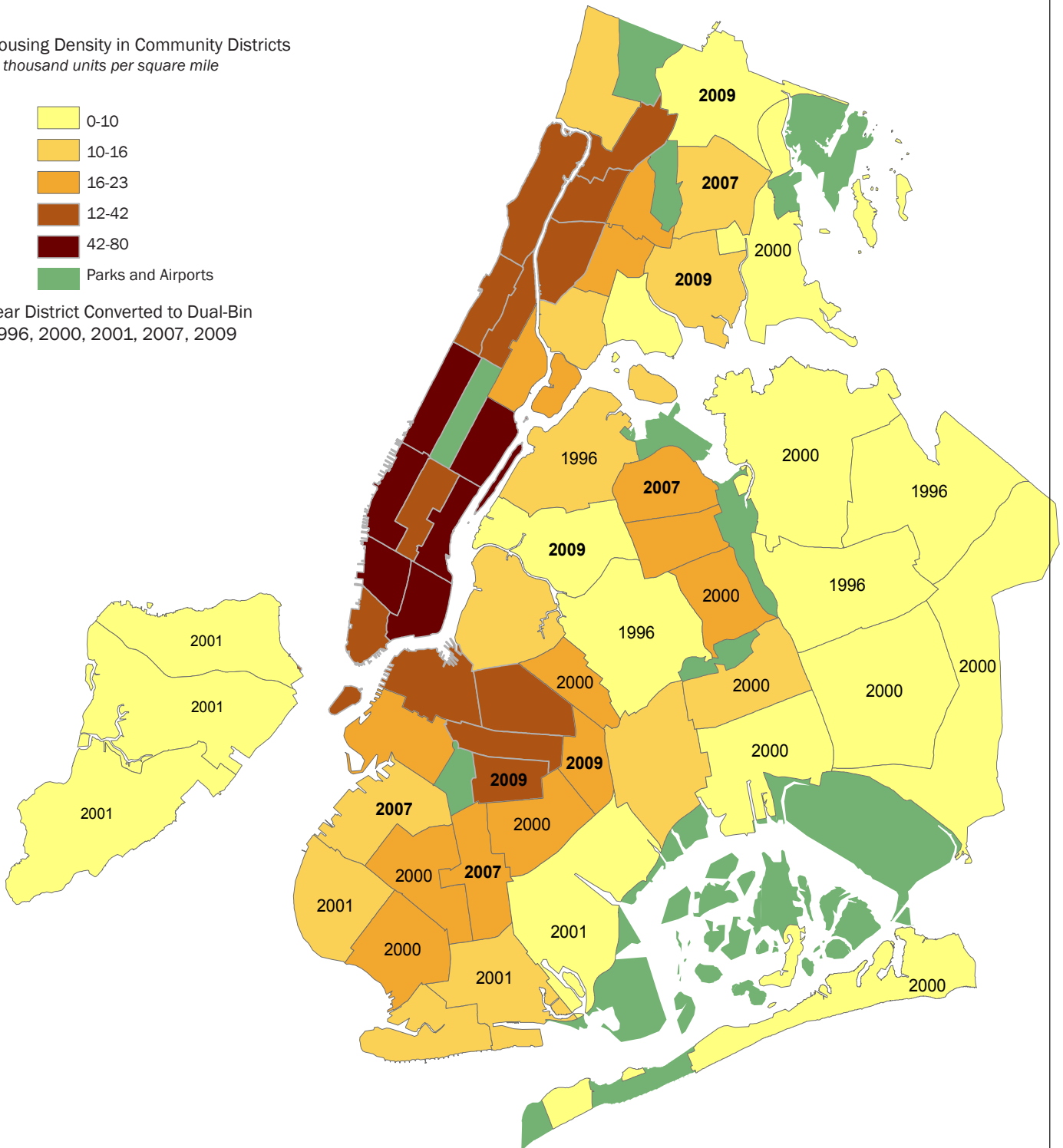
A similar result was observed in the 2009 cohort. Recycling collection productivity of the five districts increased by 15.6 percent, from 4.67 tons per truck-shift to 5.40 tons per truck-shift after dual-bin trucks were put into use. Again, although all districts saw productivity gains, there was significant variability within the cohort.

Housing Density and Year of Conversion to Dual-Bin Recycling Collection by Community District

Housing Density in Community Districts
in thousand units per square mile



Year District Converted to Dual-Bin
1996, 2000, 2001, 2007, 2009



SOURCES: IBO; Department of Finance; Department of Sanitation; Department of City Planning

Collections Before and After Switch to Dual-Bin Trucks, 2007 and 2009

Districts Converted in 2007 (n=4)

Truck Type	12 Months Before		12 Months After	
	Recycling Tons	Truck-Shifts	Recycling Tons	Truck-Shifts
Rear-Loader	36,391	7,324	3,233	603
Dual-Bin	2,689	516	35,249	5,875
Other	4	1	8	1
All Trucks District	39,084	7,841	38,490	6,480
Productivity	4.98		5.94	

Districts Converted in 2009 (n=5)

Truck Type	12 Months Before		12 Months After	
	Recycling Tons	Truck-Shifts	Recycling Tons	Truck-Shifts
Rear-Loader	24,989	5,404	2,126	505
Dual-Bin	5,348	1,070	28,290	5,131
Other	172	54	2	1
All Trucks District	30,509	6,527	30,418	5,637
Productivity	4.67		5.40	

SOURCES: IBO; Department of Sanitation

NOTES: Productivity is calculated by dividing recycling tonnage of a cohort by the total number of truck-shifts required to collect it.

Figures may not add due to rounding.

For example, collection productivity in Bronx Community District 9 (Soundview) increased by 30.5 percent, but by only 7.2 percent in Queens Community District 2 (Sunnyside). Although recycling tonnage stayed nearly constant in 2010, the number of truck-shifts needed for collection decreased by 13.6 percent. Starting in 2009, dual-bin trucks picked up 93 percent of the curbside recycling tonnage generated in the five districts.

Looking only at collection productivity of rear-loaders versus dual-bin trucks and not accounting for change in tonnage from year to year, IBO found that in these

Collections Before and After Switch to Dual-Bin Trucks, 2007 and 2009

Rear-Loader and Dual-Bin Trucks Only

	12 Months Before	12 Months After
All Districts (n=9)	Rear-Loader Trucks	Dual-Bin Trucks
Recycling Tonnage	61,380	63,539
Truck-Shifts	12,728	11,006
Truck Productivity	4.82	5.77
Percent Change	19.7%	

SOURCES: IBO; Department of Sanitation

NOTE: Productivity is calculated by dividing recycling tonnage of a cohort by the total number of truck-shifts required to collect it.

nine districts dual-bin trucks were 19.7 percent more productive than rear-loaders at collecting paper and MGP.

Increased Use of Relay Hours. Although dual-bin trucks were more efficient than rear-loaders at collecting recycling, dual-bin trucks also used more relay hours. Sanitation workers have an incentive under their contract to offload the collection truck during scheduled shift hours; they receive a payment of about \$5 per shift (known as the dump-on-shift differential) for doing so. Recycling material is offloaded at processing facilities operated by contractors rather than at city transfer stations. If the truck is not emptied by the original crew during its eight-hour shift, a different sanitation worker drives the truck to its offloading location. Usually one sanitation worker relays three or four collection trucks consecutively during a shift, oftentimes when traffic is less congested. Some vendors reimburse the city for relay costs.

Since dual-bin trucks carry two materials (paper and MGP) they have to be dumped at two different locations, one facility processing paper and another processing MGP. The extra distance traveled to offload the truck at two separate facilities, coupled with the often considerable distance between facilities, makes it less likely that a dual-bin truck will be dumped during its scheduled shift. For recycling collection citywide in 2010, 80.6 percent of dual-bin truck-shifts needed relay hours, while only 39.2 percent of rear-loader truck-shifts needed a sanitation worker to transport the truck to a dump location after the scheduled truck-shift.

To better understand the personnel costs of operating dual-bin trucks, IBO compared the share of shifts needing relay hours in the nine districts before and after the switch to rear-loaders. The share of truck-shifts requiring additional worker hours to transport and dump a truck at a processing facility increased from 67.2 percent to 97.3 percent for the 2007 cohort, and from 51.9 percent to 87.3 percent for the 2009 cohort. However, relay hours required by dual-bin trucks may decrease in the future when the new recyclables handling facility for both paper and MGP opens at the South Brooklyn Marine Terminal.

Comparing Recycling Collection Costs

Although dual-bin trucks required greater use of relay hours, these additional costs were more than offset by the trucks' greater efficiency in collecting recyclables.

Direct Collection Costs. As IBO found in prior reports, the cost of collecting recyclables consists primarily of labor,

with wages, salaries, and fringe benefits of uniformed sanitation workers accounting for approximately 99 percent of the direct cost of collection. Other costs, such as truck parts and gasoline, make up the remainder (debt service on trucks is considered separately and discussed below). Collection costs are based on the number of worker shifts that are required to run collection trucks.

In the current analysis, the cost difference between collecting recyclables using rear-loaders and dual-bin trucks results from a difference in the number of worker shifts needed, fewer differential payments for dumping during scheduled shift hours, and the personnel costs associated with relay hours. IBO used the average sanitation worker cost per shift for either collection or relay, provided by DSNY, to calculate personnel costs associated with running either a dual-bin or a rear-loader truck. Although there are modest differences in the cost of maintaining the two types of trucks, the data needed to factor these differences into our analysis were not available.⁶

IBO estimates that the productivity gains seen in the first year of implementation saved the city about \$575,000 (13.1 percent of direct collection costs) for the 2007 cohort and \$363,000 (9.4 percent of direct collection

costs) for the 2009 cohort. In both cohorts, savings attributable to a decrease in the number of sanitation workers significantly outweighed the increase in relay run costs. Estimated savings for the 2007 cohort are substantially greater than those for the 2009 cohort because the average sanitation worker salary was 6.5 percent higher in 2009, and the two cohorts experienced different increases in productivity and relay hours. While the 2007 cohort required about 16 percent fewer sanitation worker posts after the deployment of dual-bin trucks, about 13 percent fewer worker posts were needed to collect recycling in the 2009 cohort. Relay costs increased by about 22 percent as a result of the dual-bin conversion for the 2007 cohort and by about 46 percent for the 2009 cohort; at the same time, the differential payment that DSNY pays sanitation workers as an incentive to dump the collection truck on the scheduled shifts declined. These net annual savings can be considered ongoing as long as the productivity gains, controlling for changes in tonnage, are maintained.

CONCLUSION

Previous IBO analysis found that the city's per ton cost of collecting recyclables was higher than the cost of collecting

Estimated Savings Due to Switch to Dual-Bin Trucks in Nine Districts, 2007 and 2009

	2007 Cohort			2009 Cohort		
	Rear-Loader Estimate	Dual-Bin Actual		Rear-Loader Estimate	Dual-Bin Actual	
Recycling Tonnage	38,490	38,490		30,418	30,418	
Truck-Shifts (16-hr)	7,722	6,480		6,513	5,637	
Sanitation Worker Posts (8-hr)	15,444	12,960		13,026	11,274	
Truck-Shifts Requiring Relay	5,189	6,305		3,380	4,921	
Relay Workers	1,441	1,751		939	1,367	
Worker Posts Earning Dump-on-Shift Payments	5,066	350		6,266	1,432	
	Rear-Loader Estimate	Dual-Bin Actual	Savings/ (Costs)	Rear-Loader Estimate	Dual-Bin Actual	Savings/ (Costs)
Sanitation Worker Costs	\$3,951,939	\$3,316,312	\$635,626	\$3,549,432	\$3,072,033	\$477,399
Relay Worker Costs	397,446	482,907	(85,462)	275,629	401,101	(125,472)
Dump-on-Shift Payments	26,539	1,880	24,659	19,228	8,329	10,899
TOTAL	\$4,375,923	\$3,801,099	\$574,824	\$3,844,289	\$3,481,463	\$362,827

SOURCES: IBO; Department of Sanitation

NOTES: The analysis compares observed truck-shifts in 2007 and 2009 with estimated truck-shifts that would have been required to collect the same tonnage with rear-loaders. Number of truck-shifts in the Rear-Loader Estimate column is based on rear-loader productivity observed in the prior year (4.98 TPTS in 2006 and 4.67 TPTS in 2008). Share of truck-shifts needing relay hours and share of truck-shifts receiving dump-on-shift differential payments in the Rear-Loader Estimate column are based on the observed shares in prior years. Estimate of relay workers assumes that one worker relays on average 3.6 trucks per shift. DSNY received some reimbursement for relay costs for two districts in the 2007 cohort that is not reported above due to unavailability of data. Labor rate used in the calculation of sanitation worker costs is held constant within each cohort, but differs between cohorts. Figures may not add due to rounding.

Capital Cost of Collection Trucks

We considered debt service on truck purchases separately because it is not part of DSNY's programmatic cost of recycling collection.⁷ Although we could not calculate how many trucks were bought for deployment in the nine districts before and after conversion to dual-bin, the number of collection trucks that the city budgeted for decreased. The city's fleet declined by 86 rear-loaders and increased by 56 dual-bin trucks from fiscal year 2006 through 2010.

To illustrate how the change in the budgeted truck-fleet may translate into changes in annual debt service, IBO calculated the annual debt service paid on each type of truck at an annual interest payment of 5 percent spread over seven years, the average lifespan of a collection truck. Based on the budgeted fleet size in 2006, we estimate that the city would have spent roughly \$83.4 million on debt service during that year. Dual-bin trucks cost about 20 percent more than rear-loaders, but because the decline in the number of rear-loaders was greater than the increase in dual-bins, the city would have spent about \$740,000 less in fiscal year 2010 on the debt service for the truck fleet than in fiscal year 2006.⁸

It is important to note that this estimate has several limitations. The cost differential between the two types of trucks in 2009 is assumed to also apply to trucks purchased in other years. Also, all trucks are assumed to be no more than 7 years old, even though older trucks still in the fleet were likely to cost less and require smaller debt service payments. Furthermore, as the budget reflects what the agency is planning to purchase in a given fiscal year, the number and type of trucks actually purchased may be different than what was originally planned due to factors such as price or availability of trucks on the market.

refuse. This was mainly due to the relatively lower average tonnage of recyclable material collected per truck. IBO's March 2004 report concluded that since the cost of operating a Department of Sanitation collection truck is the same for recycling as for refuse, one possible way to make recycling more cost-effective would be to increase collection productivity—the tonnage of materials picked up on each truck-shift.

The city has been shifting to the use of dual-bin trucks to collect recycling (one truck collects both paper and metal,

glass, and plastic, rather than using two trucks) since 1997. More than half of curbside recycling is currently being picked up by dual-bin trucks in 31 community districts. However, the city may not be able to expand the use of dual-bin trucks to many of the remaining rear-loader districts, especially along routes with many large apartment buildings, where the amount of recycling collected on each truck-shift is already high.

IBO assessed the productivity gains from using dual-bin trucks in nine districts, one cohort in January 2007 and a second cohort in January 2009, and found that dual-bin trucks were about 20 percent more productive than rear-loaders at collecting paper and MGP in these districts. Even though there were increased costs to transport dual-bin trucks to their offloading locations, the city saw savings overall because of the lower collection cost. IBO estimated that by switching recycling collection to dual-bin trucks, DSNY saved about 13 percent and 9 percent on collection in the 2007 and 2009 cohorts, respectively. Costs to collect recycling in some parts of the city might decline further when the new recycling facility at the South Brooklyn Marine Terminal opens and is able to process paper and metal, glass, and plastic at a single location, reducing the need for the additional cost of driving dual-bin trucks to separate paper and MGP processing sites.

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ENDNOTES

¹In 2010, dual-bin trucks picked up 97 percent of all curbside recycling in the 31 districts that have been converted to dual-bin collection. The remaining 3 percent of recycling tonnage was picked up by rear-loaders, alley trucks, and other trucks.

²The following community districts were converted in 2007: Bronx 11, Brooklyn 7 and 14, Queens 3. The following community districts were converted in 2009: Bronx 9 and 12, Brooklyn 9 and 16, Queens 2. See map on page 4.

³IBO selected curbside recycling materials based on material type coding in DSNY's data. Because the data is organized at each individual truck-run level and each truck-run represents a share of the shift, truck-run collection hours are divided by 16 to normalize each truck-run to a truck-shift.

⁴IBO's measure of productivity and recycling statistics may differ from DSNY productivity targets and statistics cited in the Mayor's Management Report because it covers only a subset of waste handled by the department due to the exclusion of containerized, street basket, and institutional collections.

⁵Regardless of whether designated as dual-bin or rear-loader, all districts use some mixture of truck types depending on factors such as weather, truck availability, and targeted clean-up needs.

⁶DSNY statistics reported in the Mayor's Management Report show that dual-bin trucks have a slightly higher outage rate than rear-loaders, although the difference may be shrinking. For example, in 2008 about 16 percent of rear-loader and about 20 percent of dual-bin trucks were out for maintenance, while the difference was smaller in 2009, with about 16 percent of rear-loader and about 17 percent of dual-bin trucks out for repair. In 2010, both of these types of trucks had the same outage rate of about 18 percent.

⁷A portion of the city's expense budget is set aside to fund debt service. These expenses are not allocated to budgets of individual agencies.

⁸Dual-bin trucks cost about 20 percent more than rear-loaders in 2009. In 2011, the ratio changed, and dual-bin trucks now cost approximately 27 percent more than rear-loaders.

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