New York City Independent Budget Office Fiscal Brief

October 2021

Going Green:

Can The Organics Collection Program Be Fiscally & Environmentally Sustainable?

Summary

This week New York City is relaunching its organics curbside collection program, which was suspended over the past year due to Covid-related budget cuts. The program picks up compostable material curbside in certain areas of the city, as well as at schools and drop-off sites. With low participation rates, the city has been unable to find cost efficiencies, and even before the pandemic budget crunch, it had halted the expansion of curbside pickup. Despite years of a voluntary organics program in some form, organic material still makes up nearly half the waste the city sends to landfills. In this brief, IBO examines the cost of the city's organics program and how it relates to its broader waste system. We estimate how much organic waste the city needs to collect for the cost of the organics program to be on par with that of collecting and landfilling refuse. Among our findings:

- Although organics tonnage collected increased every year from the start of the curbside program through its last year of operation, it remained a very small part of the overall waste system. The city only diverted around 1.4 percent of its waste from landfills to organics collection.
- While total city spending on organics is a small share of the city's total waste disposal budget, on a per-ton basis, the price to collect and process organics is much higher than the city's other waste streams. In 2019, the per-ton cost to collect and process organic material was $734 compared with $216 for refuse and $206 for recycling. Most of the cost differential comes from the high per-ton cost to collect organics, as trucks picking up organics are able to collect relatively few tons along their routes, when compared with trucks picking up refuse or recycling.
- At the current cost of processing organics, IBO estimates that if the city were to expand collection citywide and New Yorkers diverted 15 percent of organics from the waste stream (similar to the recycling diversion rate), the cost differential to process and collect organics compared with refuse would drop to $39 per ton. If organics processing costs fell to $80 per ton, similar to what San Francisco pays for large-scale organics processing, this differential would be erased completely.
- More organics tonnage may require more truck runs, although any increase in greenhouse gas emissions from trucks would be more than offset by reduced emissions from diverting compostable material from landfills, one of the ways for the city to combat climate change.

The quickest route to improve the fiscal viability of organics would be to first increase participation to reduce per-ton collection costs, and then focus on reducing processing costs once a critical mass of material is collected. There is a point where large-scale organics collection could be not just environmentally beneficial but also cost effective. But to get there, city government (likely across several administrations) and the public would have to make it a priority.

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Introduction

Organic waste, such as food scraps and yard waste, represents the largest portion of New York City's residential solid waste that could be diverted from landfills, although to date, the city has had little success in establishing a program to do so. Around half of the city's refuse is organic, compostable material but, despite almost a decade of public organics collection in various forms, the city has not appreciably reduced the amount it sends to landfills. High costs and low participation rates have limited the appetite for expanding organics collection. The Department of Sanitation (DSNY) organics curbside collection program provided service to nearly half of the city by 2018. Even with this relatively large service area, the program still only managed to divert 1.4 percent of its waste from landfills to organics collection.

In 2015, Mayor Bill de Blasio announced the goal of zero waste by 2030 as part of the city's larger efforts towards sustainability and resiliency in the face of climate change. Outlined in the report *One New York: The Plan for a Strong and Just City*, the city set a goal of drastically reducing the amount of waste sent to landfills. Because much refuse is organic material (either food or yard waste), progress here relies on greatly expanding the residential curbside organics collection program with the end goal of having citywide organics collection. Instead of growing the program, however, the city halted neighborhood expansion in 2018 and then suspended it entirely in 2020 due to the Covid-19 budget crunch. In 2021, the city restored the funding to allow curbside collection service to resume in the fall, yet the future of organics recycling in New York City remains uncertain.

The residential organics program has been plagued by high costs throughout its lifetime, and if the cost per ton of handling the city's organic waste does not decline, a citywide organics program could be prohibitively costly. Yet, as the program grows, the city could achieve economies of scale, which would bring down the cost of the program. Currently, there is ongoing debate on the future path of the organics program's cost and whether the program can simultaneously be environmentally and fiscally sustainable.

In this report, the Independent Budget Office (IBO) first examines the cost structure of the current organics program and identifies the key cost drivers that make organics more expensive than collecting and processing the city's other waste streams—recycling and refuse. IBO's analysis focuses on DSNY's organics collection program, which includes residential curbside, drop-off site, and school organics collections. Commercial waste, including organic waste from restaurants is collected by private carters (not DSNY) and is not part of this study.

Next, IBO estimates how much organic waste the city would need to collect for the cost of the organics program to be on par with the cost of collecting and landfilling refuse. This analysis takes into account the efficiencies of various sanitation department truck collection routes as well as economies of scale in organics processing costs. We also examine potential non-budgetary costs and benefits of a much expanded organics program. This includes how the pollution from a projected increase in sanitation truck use, necessary for further organics curbside pickup, compares to the reduction in carbon dioxide emissions that the diversion of compostable materials away from landfills would provide.

Background

History of Organics Recycling in the City. Organics collection in New York City has a history almost as long as recycling, but instead of developing into a major collection stream the way metal, glass, plastic, and paper recycling has, organics has remained a much smaller scale operation. In the 1990s, the sanitation department created the New York City Compost Project, a program to educate the public about composting, which also included a demonstration composting site at city botanical gardens. At around the same time, the department also experimented with composting tree and yard waste collected in Staten Island and Brooklyn. Over time, this program expanded to other boroughs and became the Fall Leaf Collection Program, which continues to operate. The city did not expand beyond yard waste collection until 2011, when it partnered with Greenmarkets to begin accepting organic waste dropped off at their locations. A year later, in 2012, 90 public schools in Manhattan, Brooklyn and Staten Island piloted a school organics collection program after students and parents expressed an interest. Organics collection, nevertheless, remained widely unavailable in the city.

The seeds of the curbside program were planted in 2013 when City Council passed Local Law 77, mandating that DSNY establish a voluntary curbside organics collection that would run as a pilot program through 2015, as well as expand the school organics collection program. DSNY started the curbside program in Brooklyn and Staten Island with $1.8 million in annual funding during fiscal year 2013. In 2015, instead of ending the pilot, DSNY expanded it to all five boroughs. Within two years, with several rounds of expansion, 3.5 million city residents had access to curbside organics service, and DSNY had plans to further expand into additional neighborhoods. Although many city residents had curbside pickup available to them, far fewer actually participated. This low participation rate caused DSNY to halt expansion to additional neighborhoods in 2018, while continuing the existing service as the city searched for ways to improve participation. During this period, the city also began mandating organics separation on the commercial side, with requirements for large food manufacturers, stadiums and large hotels to separate organics in 2016, followed by large food stores and service establishments in 2018 and medium-sized food service locations and stores in 2020. Because establishments covered under these rules receive waste collection service from the private sector, the mandates did not impact DSNY's collection programs.

Under the Prior Program, Organics Collection Was Costly. After several years of operation, organics collection tonnage was not rising quickly enough to lead to a fiscally sustainable, environmentally virtuous cycle of higher tonnages resulting in lower costs per ton; after 2018, expansion remained on hold, and costs were high. In fiscal year 2019, the last full year of operation, the organics program cost $32.2 million although it was only baselined at around $23 million in future years. This combination made the program vulnerable when the city faced difficult budget choices during the pandemic.

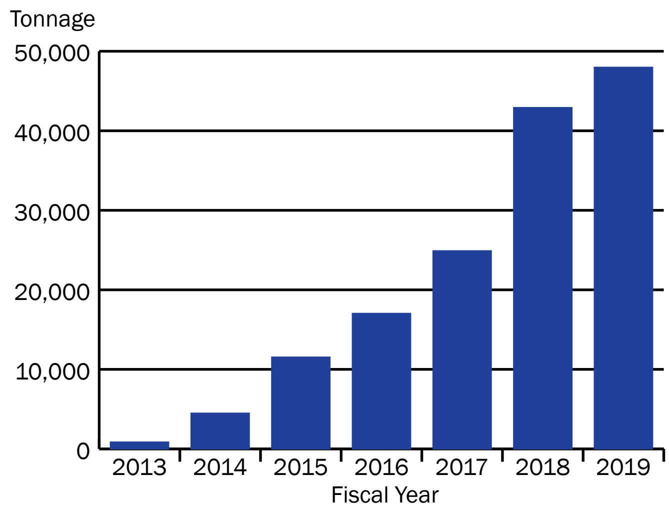
As part of citywide budget cuts, the organics collection program was cancelled in 2020, producing $21 million in savings for fiscal year 2021, although some funding for drop-off sites was later restored. Shifting organics tonnage back to the refuse stream on a temporary basis immediately realized savings for the city with minimal disruption to critical services. Although the city was without curbside organics collection for a year, the city restored funding for the program in last spring's 2021 Executive Budget, which funds a restart of the program during fall of 2021. The new program is similar to the previous one and operates in the same limited areas of the city. However, curbside collection is now only provided for residences that opt-in for pickup, rather than pickup happening along a set route determined by the city, which is how recycling and refuse collection operate and how organics also operated before its cancellation. While only running trucks for pickup at residences that expressed interest in participating may be more efficient than comprehensive, preset routes, the opt-in model adds a barrier to participation that previously was not there. Additionally, although the program provides service to all previous participants, a loss in waste sorting habits and infrastructure may prevent the opt-in version of the program from collecting as much organics tonnage as it previously did.

State of Organics Program at Time of 2020 Cancellation

Low But Rising Organics Collection Volume. Despite the high cost and low tonnage collected, organics was still a growing part of the city's waste management system, even up through the point of cancellation. From the start of the curbside program in 2013 through 2019, the last complete fiscal year before the pandemic, organics tonnage increased steadily but not at a rate that would allow it to evolve into a thriving program in the near future. (Hereafter, all years refer to city fiscal years). After expansion was halted in 2018, the growth rate slowed, although the total volume of organics collection continued to increase from 2018 through 2019 because of increased participation in existing routes and drop-off sites. In 2019, DSNY collected 48,000 tons through organics collection as compared with 43,000 tons in 2018. This is in contrast, however, to three million tons of refuse collected in 2019; the organics collection remained a very small part of DSNY's overall waste collection system.

Per Ton Cost of Organics Program Markedly Higher Than Refuse and Recycling. There are two main costs associated with handling each of the city's waste streams: collection and processing. DSNY trucks collect each waste stream separately (refuse, organics, co-mingled metal, glass, and plastic recycling, and paper recycling) to avoid contamination and then haul them to private exporters,

Organics Collection Tonnage Steadily Increased Until 2020 Cancellation



SOURCE: Department of Sanitation collection data

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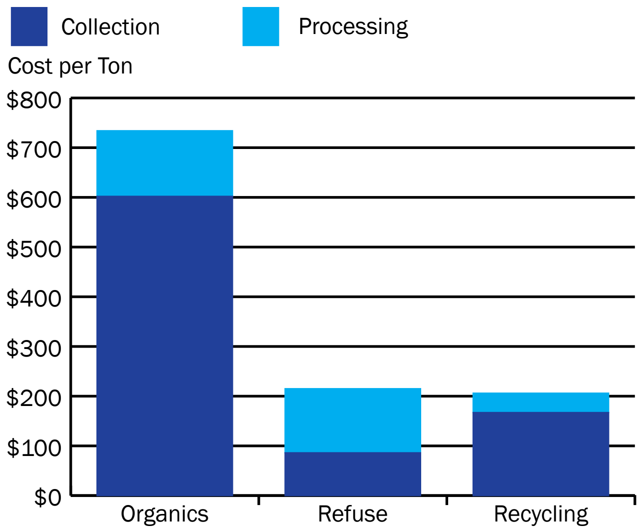
Collection and Processing Cost Per Ton Higher for Organics Than Refuse or Recycling



SOURCE: IBO analysis of 2019 Department of Sanitation cost per ton data
NOTE: All costs exclude overhead and other indirect costs.
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recyclers, or composters who hold contracts with the city to process them. (While recycling collection is generally split into two routes, one for paper and one for comingled metal, glass, and plastic, their costs are considered together for this brief).

In 2019, the last fiscal year before the Covid-19 crisis, organics collection cost an average of $602 per ton while the processing of organics materials cost an additional $132 per ton, making the total cost for organics collection and processing $734 per ton. In comparison, the total cost for refuse collection and export processing to bring refuse to landfills in 2019 was $216 per ton and the total cost for recycling collection and processing was $206 per ton. (All costs exclude overhead and other indirect costs.)

The cost of organics processing is not much more than the cost of refuse export, $132 per ton compared with $129 per ton in 2019, respectively. (Recycling has the lowest processing cost of $39 per ton.) However, the very high cost of collecting organics, $602 per ton, is far greater than the cost of collecting refuse at $86 per ton and the cost of collecting recyclables at $167 per ton, meaning that the main driver of the cost disparity between organics and refuse is collection cost. Accordingly, there is no way to bring the cost per ton for the organics program to near parity with refuse or recycling without better controlling collection costs.

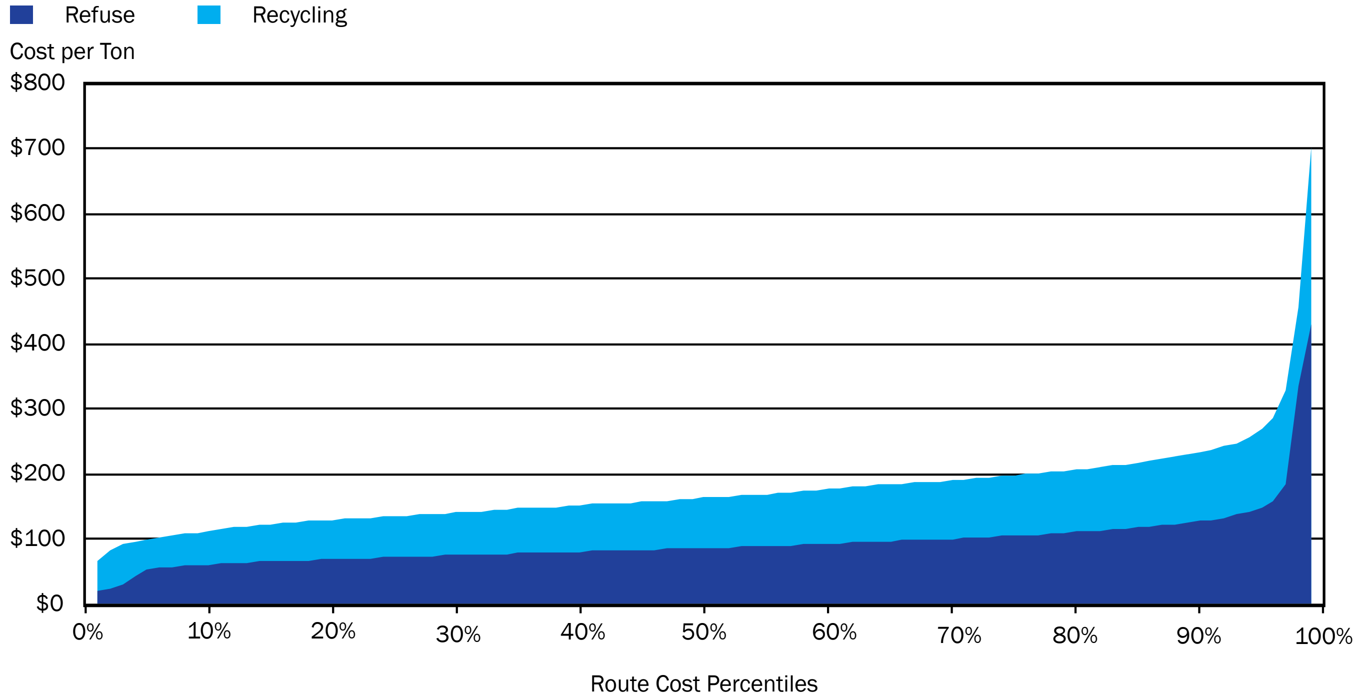
Refuse and Recycling Largely Have Equally Efficient Routes. Labor costs are one of the largest expenses for the sanitation department, and therefore, collection costs are largely driven by the tons of waste material that can be collected per hour or truck shift. The costs of running a truck through a given route are relatively fixed, while the amount of refuse, recycling, or organic material to be collected can vary greatly. Therefore, the key to decreasing cost per ton is having available curbside tonnage on a route be roughly equal to the maximum amount that can be collected in a single truck shift. The more curbside tonnage, the cheaper per ton it becomes to pick up any of the waste streams DSNY collects.

DSNY employees drive more than 400,000 routes annually between refuse, recycling, and organics. The department has some latitude to arrange truck routes so that they are as efficient as possible, but it is also subject to constraints. For example, single bin trucks can carry around 12 tons of waste, so the expected available material on a route cannot exceed that quantity. Route lengths are designed to not be so long as to routinely incur overtime expenses. Additionally, pickup must occur frequently enough to avoid nuisance or vermin problems; even if an area does not generate enough waste to allow highly efficient collection routing, it still requires regular service. DSNY does have the option to use dual bin trucks, which collect paper and comingled metal, glass, and plastic on the same route if appropriate. The sanitation department also adjusts routes to improve efficiency, but it must account for weekly and seasonal variation in the amount of waste on a given route, meaning that it cannot plan to perfectly fill each truck.

The result of this optimization problem for the department is a range of routes for all the waste streams—some that pick up only a few tons and are relatively inefficient and others that are highly efficient and return trucks nearly full. Between these extremes are a majority of routes that pick up enough waste to be relatively efficient leading to largely consistent costs per ton across most routes. For both refuse and recycling, the difference between the cost per ton of routes in the 20th percentile (lower cost per ton) and routes in the 80th percentile (higher cost per ton) is relatively small—only $42 and $77 per ton, respectively—indicating that tonnage is well-distributed and efficient on the majority of routes. Generally, DSNY can collect waste at between $130 and $200 per ton for recycling and $60 to $110 per ton for refuse.

Organics Collection Costs Vary Widely Across Truck Runs. By comparison, there is a much wider gap between more and less efficient runs for organics, and there is no large population of relatively efficient pickup routes that indicates optimized collection. Instead, almost no routes are close to collecting enough material to create a cost

Refuse and Recycling Routes Largely Consistent in Cost per Ton



SOURCE: IBO analysis of 2019 Department of Sanitation collection data

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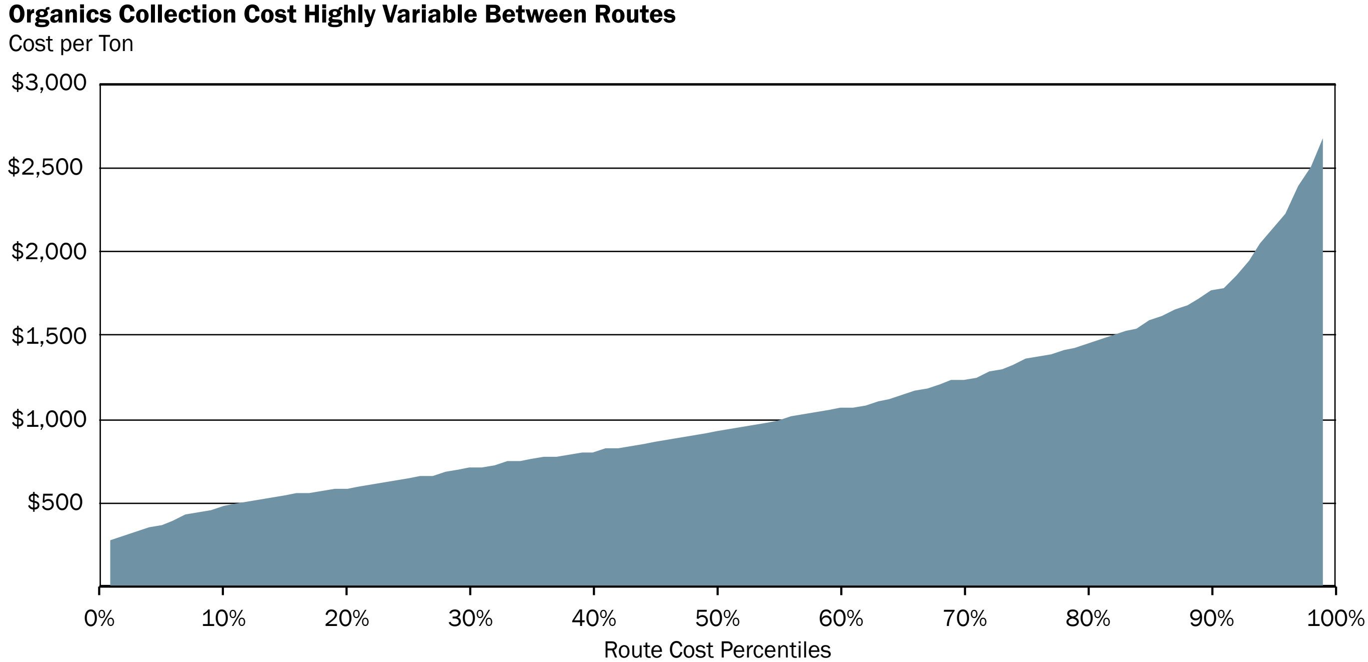
efficient route and the cost per ton rapidly increases at higher cost percentiles. At the 20th percentile for organics collection routes, the cost is $585 per ton, while at the 80th percentile, the cost is $1,450 per ton, an 85 percent increase. This is indicative of a collection program that is starved for tonnage and is mostly constrained by the need to provide regular service, with few options for DSNY to adjust the frequency of pickups to generate more efficient route arrangements. For example, there are no routes that are relatively oversupplied with organics tonnage that could be shifted to a less full truck. Instead, virtually every route has room in the truck for more tonnage. More tonnage of

Organics Collection Cost Highly Variable Between Routes



SOURCE: IBO analysis of 2019 Department of Sanitation collection data

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organic material curbside would provide more opportunities for DSNY to optimize collection and reign in the collection cost per ton. This in turn would bring the cost distribution of truck routes down, closer to something resembling the cost curves for refuse and recycling.

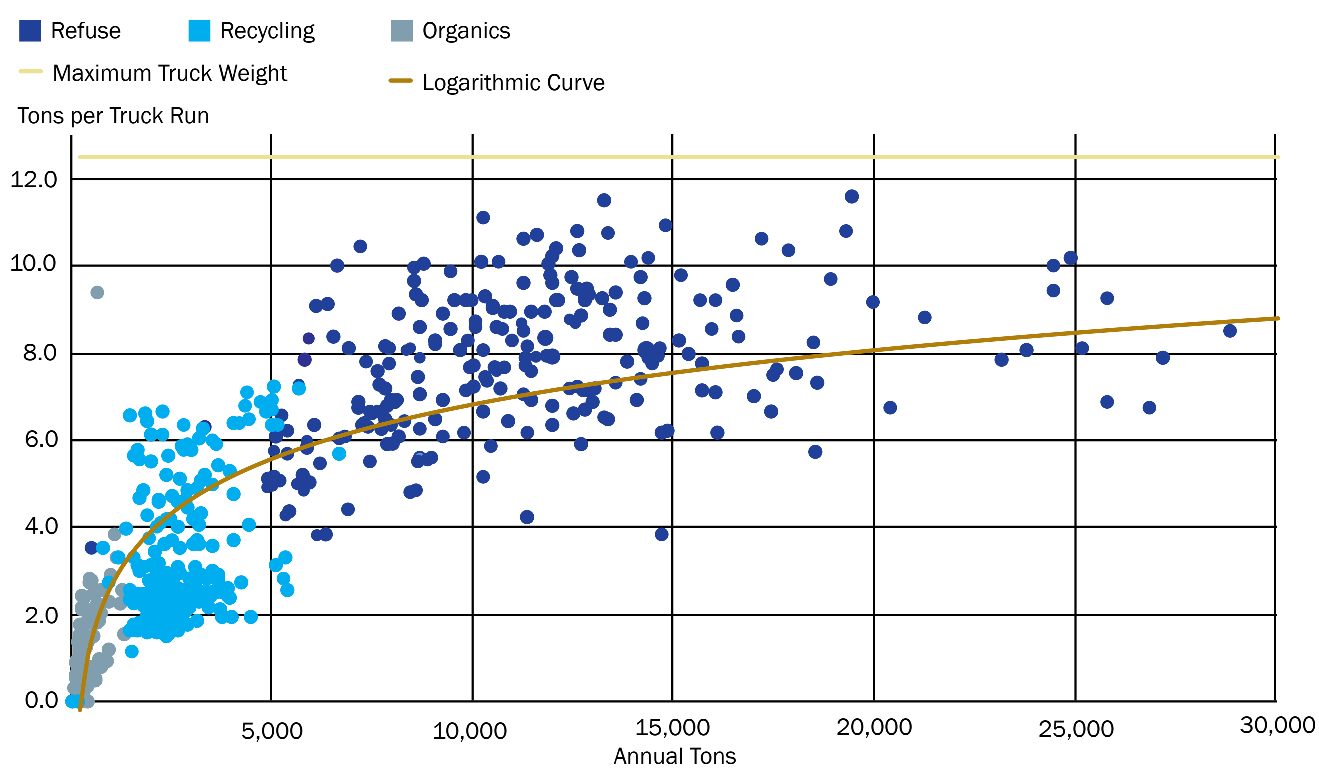
Quantifying The Relationship Between Collection Tonnage And Cost

Additional Tonnage Yields Cost Per Ton Savings. DSNY seeks to arrange waste collection routes to maximize operational efficiency. In the long run and within their constraints, collection streams with more tonnage available provide DSNY more flexibility to design efficient and well-functioning routes, while waste streams with little tonnage, such as organics, are already at the minimum service level to provide regular pickup service. Therefore, under the current organics program, there are few actions the department can take to create more efficient routes. The opposite is true for recycling and refuse, where the department can shift routes, timing, or type of equipment to boost efficiency. These efficiency-boosting actions are the mechanisms by which waste streams with greater tonnages can have more cost-effective collection.

However, the size of the efficiency boost generally shrinks as the quantity of waste in a stream increases. Additional tons in the refuse stream of already rather full truck runs does little to create more efficient routes in terms of cost per ton of collection because DSNY trucks are already operating at functional capacity with little room for improvement. Conversely, small increases in tonnage in the organics stream would have much more substantial impacts on the cost per ton of collection because there is considerable extra capacity in these organics routes to accommodate more volume without requiring additional trucks. For example, adding 1,000 tons to a low tonnage organics or recycling section that currently collects 2,000 tons per year, would increase tonnage per truck run by 18 percent, while doing the same in an area that already collects 15,000 tons per year would only increase tonnage per truck run by 2 percent.

The relationship between annual tons and the tons picked up during a typical truck route forms a logarithmic curve where large increases in tons per truck, and therefore, efficiency, are possible up to around 5,000 annual tons on a given route.[1] Where the slope of the log curve is steep, increasing tonnage has a large effect on reducing per ton costs, and where the slope of the curve is flatter, additional

As Annual Tons Increase, Truck Runs Become More Efficient



SOURCE: IBO analysis of 2019 Department of Sanitation collection data
NOTE: Dots represent collections tonnage at the sanitation department district section level.

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tonnage has a smaller impact on tons collected per truck run and—by extension—cost. A major driver of possible cost savings for the organics program is the modest impact on per ton refuse costs of diverting waste from refuse to organics, and the much larger impact on per ton organics collection costs that this additional material would have. Furthermore, although recycling collection is relatively efficient, many metal, glass, plastic and paper routes could also benefit from additional tonnage.

Adjusting tonnage available for collection enables routes to shift along the log curve, creating per ton savings or costs. The point where the average organics, recycling, and refuse routes are all collecting the same tons per truck run is also the point where collection costs would be the same for each waste stream. Assuming that households create the same amount of waste, every ton added to the organics or recycling stream is subtracted from the refuse stream and vice versa. Diverting more refuse tonnage to recycling or organics would lead to a relatively small increase in costs per ton for refuse, but a much larger reduction in the per ton costs for the recycling and organics streams. Diverting refuse, where appropriate, to recycling or organics collection would therefore aid the convergence to cost parity for all three streams and potentially reduce costs overall.

The balance between diverting material to different waste streams is what governs collection cost, and more savings can be created faster in organics and recycling than costs rise in the refuse stream—up to a point. By modelling different potential future diversion rates (the percent of waste diverted from refuse collection to another collection, such as organics or recycling), IBO can estimate the resulting collection cost per ton and the cost of a future organics program under different scenarios.

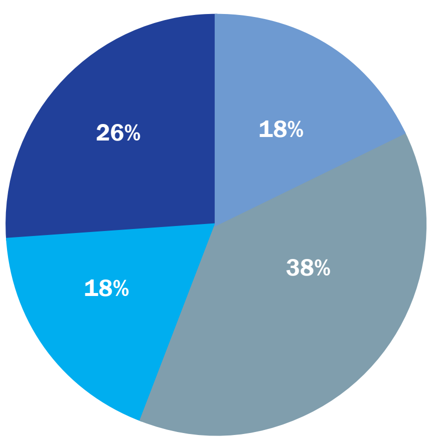
Not all material in the waste stream is appropriate to divert to other collection streams, however. While any material can be accepted by the refuse stream, only designated paper, metal, glass, and plastic materials can go in recycling and only compostable materials can go in the organics stream. If all materials were correctly sorted, DSNY's 2017 Waste Characterization Study found that for all forms of waste collected citywide, around 38 percent of material in the city's curbside collection is eligible for organics diversion, while an additional 36 percent is recyclable as metal, glass, plastic or paper. The remaining 26 percent can only be placed in the refuse stream as there is not yet any process available to recycle this waste in New York City.

By comparison, the 2017 Waste Characterization Study found that of what is being thrown out as refuse (i.e. what goes to landfills), 46 percent is organic and 23 percent is recyclable—material that could be diverted away from refuse if it were sorted properly. In fact, only around 17 percent of the city's waste is actually diverted to recycling and around only 1 percent is diverted to organics. Thus,

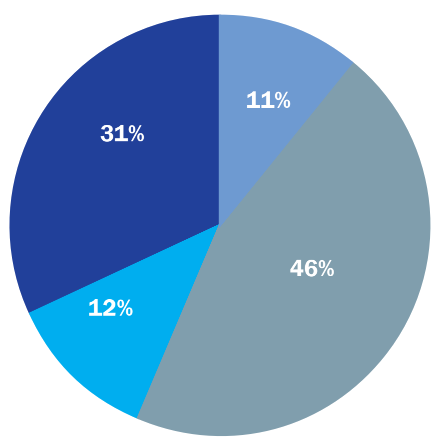
Refuse Stream Contains Substantial Divertible Material

Refuse | Metal, Glass, Plastic | Organics | Paper

Total Waste Stream Composition



Refuse Stream Composition



SOURCE: IBO analysis of 2017 Department of Sanitation Waste Characterization Study
NOTE: "Waste Stream" refers to the entirety of waste material DSNY collects, including items that are recycled, composted or landfilled. "Refuse Stream" refers to the material that is being sent to landfills, regardless of whether it is recyclable or compostable, or not.

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there is substantial room for the diversion rates of recycling and organics to grow without running out of material.

Export and Processing Are Also Important Cost Drivers. Collection costs are not the only contributor to the cost of waste removal in the city. Once collected, material must be either processed or exported to landfills. As with collection, processing costs for organic material currently exceeds the cost to export refuse to landfills. However, the cost per ton difference is much less than on the collection side. IBO calculated that organics processing costs $132 per ton, only $3 per ton more than refuse landfilling (inclusive of transport costs), and there is potential to reduce organics processing costs further. If less non-organic material were mingled into the organics stream, processing organics would be less costly. In addition, organics can create usable material that can produce revenue to defray costs, unlike refuse, which has no value. If waste organics are added to the Department of Environmental Protection's anaerobic digesters, it can produce methane, which can be cleaned and sold to heat homes in the city. Alternatively, compost can be sold for agricultural and gardening purposes.

In addition to direct revenue, organics could also generate savings for the city by creating carbon offsets and averting greenhouse gas emissions. Other municipalities in the United States are both selling compost and realizing revenue from carbon offsets, so this approach could be a feasible way for New York City to reduce the cost of processing the material to the point where it is below the cost of waste export. This, however, would require that sufficient demand exists for compost production and carbon credits on the scale of what New York City could produce—a demand level that is currently unknown. Historically, the cost of waste export to landfills has escalated over time for New York City, from an inflation-adjusted per-ton cost of $101 in 2014 up to $129 in 2019, so finding an alternative and less expensive disposal method for waste that can be diverted from the refuse stream could help stem the growth in cost of the overall waste system in the future.

Exploring The Total Cost Differential Between Refuse And Organics

Organics Participation and Material Acceptance Expansion Needed to Achieve Cost Parity with Refuse. Waste in New York City is a three-part stream, with refuse, recycling and organics. IBO examined how costs would shift across the three streams if some tonnage currently being thrown out as refuse were properly diverted to recycling or organics instead. IBO modeled organics collection and processing cost changes if the tonnage of refuse were to decrease by an equivalent amount that organics and recycling tonnage increased. This allowed us to estimate the diversion rates necessary for organics and recycling to bring the total per ton cost of organics on par with that of refuse.

Under the current DSNY cost structures, the combined cost of collection and disposal for organics would only reach parity with refuse collection and export if the city were to exceed 30 percent diversion for both organics and recycling. This would require diverting nearly all available organics and recyclables as these components make up 38 percent and 36 percent of the entire waste stream, respectively. This is a nearly impossible standard for the city to achieve, requiring universal participation and almost perfect sorting by the public. Before the organics program was halted, the citywide diversion rate was 1.4 percent for organics and 17 percent for recycling. Realistically, in order to achieve diversion at a level around 30 percent for both organics and recycling, the city would have to expand the list of materials it accepts for recycling and organics processing, or public consumption habits would have to change to either produce less refuse or replace non-recyclable material with recyclable or compostable material.

Even at diversion rates below the point of cost parity, increasing organics diversion rates is fiscally attractive for the city. If recycling stays at its current rate hovering around 15 percent, and the organics diversion rate increased to 15 percent the organics/refuse cost differential would drop to $39 per ton. Shifting the organics diversion rate from 15

At Current Processing Costs, High Diversion Rates Required to Bring Organics Costs On Par with Refuse

		Organics/Refuse Cost Differential At Current Processing Costs				
Organics Diversion Rate	35%	$8	$6	$3	$0	($4)
	30%	$14	$12	$10	$7	$4
	25%	$20	$19	$17	$14	$12
	20%	$28	$27	$25	$23	$21
	15%	$39	$38	$36	$35	$33
	10%	$56	$55	$54	$52	$50
	5%	$95	$93	$92	$91	$89
		15%	20%	25%	30%	35%
		Recycling Diversion Rate				

SOURCE: IBO analysis of Department of Sanitation collection and export data
NOTES: Positive amounts indicate how much more the total cost per ton for organics would be relative to refuse. Negative amounts indicate how much less the total cost per ton for organics would be relative to refuse.
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percent to 20 percent would lower the organics/refuse cost differential from $39 to $28 per ton, an additional savings of $11 per ton. If the organics diversion rate were 15 percent, but the recycling diversion rate increased from 15 percent to 20 percent the organics/refuse cost differential would decline from $39 to $38, a savings of $1 per ton.

Cost of Organics Processing Lowered Through Economies of Scale. In order to get to a point where the overall cost per ton of managing organics is comparable to refuse at organics diversion rates that are more realistic, the city would have to reduce organics compost processing costs from the current $132 per ton to around $100 per ton. This $100 per ton rate is similar to what the city presently pays for truck and rail refuse export, so existing infrastructure may be able to support this cost level. Processing costs of $100 per ton would open the possibility of organics per ton costs dropping below refuse at a 20 percent diversion rate. At current processing costs, a 15 percent recycling diversion rate and a 20 percent organics diversion rate puts organics total costs at about $28 more per ton than refuse, but lowering the processing costs to $100 per ton would then eliminate this differential.

Dropping the processing cost further, to $80 per ton, would allow organics to be less expensive than refuse at as low as a 15 percent organics diversion rate. An $80 per ton processing cost is comparable to the per ton cost of large-scale composting operations near other cities with large organics programs, such as San Francisco, so with a major investment to achieve economies of scale, it may be feasible for New York City too.[2] When the city faced a similar problem on how to manage the recycling stream in a fiscally sustainable way, it was able to leverage $60 million in city funds, in conjunction with the promise of a long-term contract, to attract private funding to create a $110 million investment in the SIMS Material Recovery Facility in Sunset Park, Brooklyn.

Achieving organics cost per ton parity with refuse, at a $80 per ton processing cost, would also require a recycling diversion rate of at least 15 percent—which the city has already achieved—and an organics diversion rate of 15 percent. Below 15 percent organics diversion, organics processing would need to be unrealistically inexpensive to make up for the collection cost gap. Getting organics diversion to 15 percent would be a large jump from the rate under the previously suspended program that diverted 1.4 percent, but would be feasible with buy-in from the same population that is already complying with mandatory sorting for recycling.

Reducing Organics Processing Costs Yields More Scenarios Where Organics is at Cost Parity With Refuse

Organics Diversion Rate	Organics/Refuse Cost Differential At Current Processing Costs				
	Recycling Diversion Rate 15%	**20%**	**25%**	**30%**	**35%**
35%	$8	$6	$3	$0	($4)
30%	$14	$12	$10	$7	$4
25%	$20	$19	$17	$14	$12
20%	$28	$27	$25	$23	$21
15%	$39	$38	$36	$35	$33
10%	$56	$55	$54	$52	$50
5%	$95	$93	$92	$91	$89

Cost Parity for Organics and Refuse at Current Processing Costs	Cost Differential Eliminated If Organics Processing Costs Brought Down to $100 Per Ton	Cost Differential Eliminated If Organics Processing Costs Brought Down to $80 Per Ton	Organics More Expensive Than Refuse Under All of the Above Scenarios

SOURCE: IBO analysis of Department of Sanitation collection and export data

NOTES: Positive amounts indicate how much more the total cost per ton for organics would be relative to refuse. Negative amounts indicate how much less the total cost per ton for organics would be relative to refuse.

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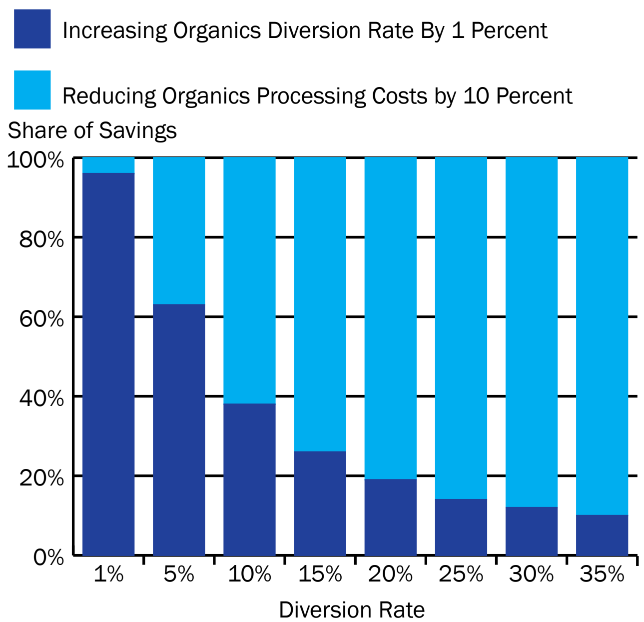
If diversion rates improve beyond 15 percent, a more favorable cost differential would make defraying processing costs less essential.

Improving Diversion Rates Would Produce More Initial Savings. While it is important to reduce both the cost of collecting and processing organics, these advantages do not accrue equally. At very low diversion rates, the additional savings available from improving diversion rates, and thereby collection tonnage, are much larger than from reducing processing costs. At a 1 percent diversion rate, 90 percent of the savings associated with incrementally improving the diversion rate and processing costs are from improving collection efficiency, while at diversion rates above 20 percent, 90 percent of additional savings are attributable to lower processing costs. Under the most recent organics program, there was little organic material collected on the truck routes, so the high per ton processing cost had a far smaller effect than the collection cost. However, when enough material is collected that truck runs are relatively efficient, potential processing cost per ton savings quickly dominate. Once organics diversion reaches 5 percent, more than half of the additional savings is from processing costs. At higher

Increased Organics Tonnage Produces Large Collection Savings Early On



SOURCE: IBO analysis of 2019 Department of Sanitation collection and export data

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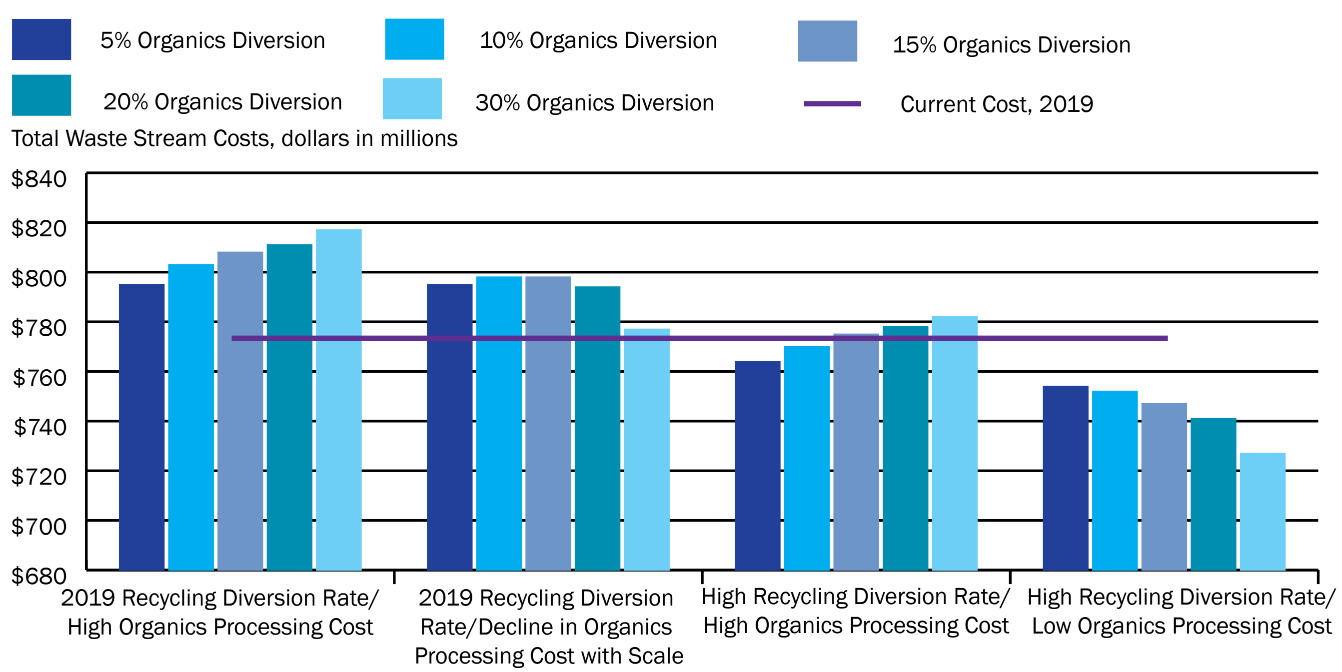
diversion rates, reducing processing costs is far more important than increasing participation for generating savings. Therefore, in terms of cost reduction, IBO finds that focusing on improving participation yields the greatest initial savings. Once participation rates have begun to ramp up, however, it is necessary to focus on reducing processing costs to yield additional savings.

Expanding Organics Participation Increases Total DSNY System Costs, At Least in The Short Run. Looking forward, with the upcoming opt-in model for the renewed organics program, the question of whether the diversion rate will match or exceed its previous level of 1.4 percent could be a bellwether for where the program is headed. The volume collected and cost of processing organics has implications for the total cost of DSNY's curbside waste collection and export system, and future iterations may be more or less expensive than costs in the current system.[3] While the cost per ton of organics collection may decline, if processing costs for organics remain unchanged, or an increase in organics tonnage does not come with a commensurate reduction in refuse tonnage, the DSNY waste system may see an increase in overall costs. There are many different potential scenarios, each with different implications for future costs. Of course, the most direct way to reduce DSNY costs is for city residents to produce less waste. Producing less waste is always the most cost-effective option, but assuming that waste production is constant, different quantities of refuse, recycling and organics collection can produce substantial costs or savings.

Reduced Costs from Higher Recycling Diversion Rate And Lower Organics Processing Cost



SOURCE: IBO analysis of 2019 Department of Sanitation collection and export data

NOTES: Total cost of waste stream includes collection and processing costs of citywide organics, refuse and recycling curbside collection. "High recycling diversion rate" assumes 30 percent diversion rate. The 2019 recycling diversion rate was 17 percent. the current cost of organics processing is $132 per ton and low processing cost assumes $80 per ton. All collection and export costs are in 2019 dollars.

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Under current conditions, assuming the recycling diversion rate remains stagnant at 17 percent and the cost of processing organics remains at its current level, ramping up organics diversion increases overall DSNY costs. Boosting the organics diversion rate to 15 percent would drive system costs to $808 million and higher as organics diversion increases. Under other scenarios, such as assuming a decline in organics processing costs to $80 per ton due to economies of scale, IBO estimates that organics diversion rates at 30 percent would result in total costs of $777 million—just slightly above the current $775 million level.

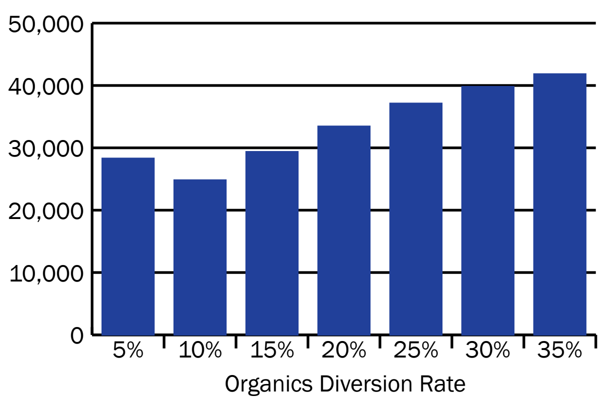
The only scenario in which total costs are below the current system at every level of organics diversion is one where recycling diversion approaches 30 percent over time and organics processing costs are simultaneously brought down to $80 per ton. In this scenario, the high recycling diversion rate drives the savings when the organics diversion rate is still low; IBO estimates that the system costs would total $754 million under this scenario if there were a 5 percent organics diversion rate. As organics diversion ramps up, costs could drop even lower as both organics and recycling streams achieve 30 percent diversion, when IBO estimates that the cost of the system would total $727 million.

Carbon Dioxide Emissions Considerations

Citywide Organics Collection Would Increase Truck Runs But Still Reduce CO_2 Emissions. Moving to citywide curbside organics collection would require more truck runs than were devoted to organics in 2019 when only part of the city was covered under the curbside program, assuming DSNY continues to use its existing fleet of single- and dual-bin trucks. In 2019, there were 54,740 organics collection truck runs. As organics diversion increases, more trucks runs would be required once the existing extra capacity in routes is filled with additional organic material. If no truck runs were converted or removed as diversion habits shift, many more truck runs would be required, but because truck runs can be repurposed to pick up other materials, the total required increase in runs is modest. DSNY has more than 400,000 truck runs annually for curbside pickup, and IBO estimates that roughly 25,000 to 43,000 more truck runs per year would be required to handle four separate large waste streams—refuse, organics, paper recycling, and comingled metal, glass, and plastic recycling–if curbside organics pickup were expanded citywide.

Citywide Expansion of the Organics Program Requires More Truck Runs

Additional Truck Runs, 2019 Baseline



SOURCE: IBO analysis of 2019 Department of Sanitation collection data
NOTE: Additional truck runs reflect expansion of curbside service citywide.

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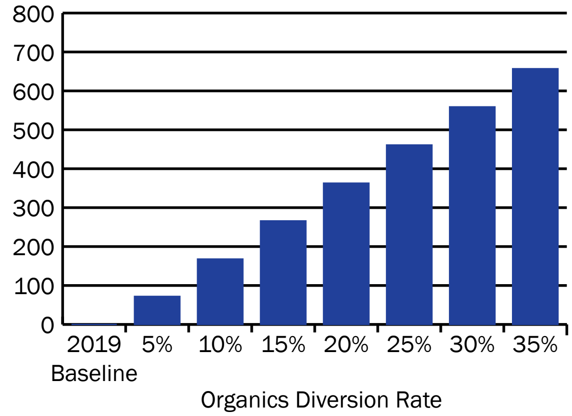
More truck runs mean negative externalities: traffic congestion, local air quality impacts, and noise. This in turn could worsen conditions in already overburdened neighborhoods if organics are routed via the same transfer stations where sanitation infrastructure is already clustered. Emissions from excessive truck traffic has been identified as a cause of asthma clusters and other public health issues in New York City. Switching DSNY's fleet to clean-fuel or zero emission trucks could alleviate some of these impacts. Alternatively, organics could be exported via the marine transfer stations using barges, but considering the high cost of marine transportation, it could make organics more expensive than it already is. Based on IBO's models, fewer truck runs would be needed at an organics diversion rate of 10 percent than at a diversion rate of 5 percent. At the 10 percent diversion rate, trucks on all four types of runs (organics, refuse, paper recycling, and comingled metal, glass, and plastic recycling) are largely full, allowing for greater efficiency across all truck runs. Since a minimum level of pickup frequency is required, as organics diversion moves higher, refuse trucks become less full, reducing truck collection efficiency.

IBO estimates that increasing the organics diversion rate to 15 percent would increase annual CO_2 emissions from fuel usage by around 3 percent or around 2,600 tons per year. Despite the increased fuel usage and increased emissions from the additional truck runs, however, increasing organics diversion will reduce overall CO_2 emissions. Organics deposited in landfills emit methane, a potent greenhouse gas, for years as the material rots. Substantial greenhouse gas savings are possible if these methane emissions are averted via composting or anaerobic digestion, even if the compost or natural gas eventually release CO_2. A 5 percent organics diversion rate would reduce CO_2 emissions by 72,000 tons, while

Potential CO_2 Emission Savings from Composting Much Larger than Emissions from Additional Trucks

Tons of CO_2 Emmissions Averted, in thousands



SOURCE: IBO analysis of 2019 Department of Sanitation collection data
NOTES: Emission savings assume that organics are composted. Tons of averted CO_2 emissions are net any changes related to truck runs.

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if almost all citywide organics were diverted (a 35 percent diversion rate), CO_2 emissions would be reduced by 657,000 tons per year. Using a U.S. Environmental Protection Agency estimate for social cost of carbon—set at $42 per ton—the city could avert between $3 million and $28 million in carbon social costs at organics diversion rates of 5 percent and 35 percent, respectively, after accounting for the CO_2 associated with the need for additional truck runs.

Conclusion

Inefficient collection routes due to low tonnage was the main driver of high costs in the previous curbside organics program. Increasing participation and thereby the tonnage collected, however, is not enough to control these costs. In order to create a cost-effective organics program, the city must also find a way to reduce current processing costs. For example, the city could reduce costs by developing markets for city compost, generating carbon offsets from the greenhouse gas savings or simply investing in larger facilities to capture economies of scale. In the long run, if organics diversion grows and DSNY continues to optimize their route patterns, a waste system is possible where organics costs are at or even below the cost of refuse collection and disposal.

Despite the potential for future savings, the pathway to get to an organics program that is on par with costs of recycling or refuse is likely to be expensive. Public behavior does not change overnight and the city would have to provide frequent curbside service as households become accustomed to separating organics. During the 1990s—a period of rapid expansion of the curbside recycling program—diversion rates went from 5.4 percent in 1992 to 20.2 percent in 2000, an 8-year span of building public participation. It will also take time for DSNY to adjust and optimize routes as the public shifts behavior, meaning that the long run projections outlined in this report are unlikely to be realized any time soon.

Higher organics diversion incurs more costs than it saves as DSNY may have to support frequent collection of both organics and refuse before some routes can be safely cut without affecting service or operations. As this transition will occur over many years, improvements would likely show up in the city budget as more gradual increases in costs, rather than as savings.

The quickest route to cost sustainability in the organics program is first increasing participation to bring down collection costs and then focusing on reducing processing costs once a critical mass of material is being diverted. Processing is likely to remain expensive in the near future. If the city were to develop large-scale organics processing capacity close to the city in the near term, it would be initially underutilized as the city works to increase its diversion rate. Alternatively, if the city waits until organics diversion is higher to invest in large-scale processing facilities, it may end up paying higher processing costs as supply exceeds nearby capacity until new compost facilities are built.

In any scenario, this process would be long-term and likely span multiple mayors and City Councils. While there exists a point at which large-scale organics collection in New York City is cost effective relative to other DSNY waste streams, the city would have to make getting the program to such a point a long-term priority.

Expanding the curbside program will also require more truck runs, which will increase congestion and the negative environmental impacts of DSNY's fleet. Even accounting for the increased fuel required, however, organics collection will reduce overall CO_2 emissions, which represents one of the most effective ways for the city to combat climate change by shrinking the quantity of waste sent to landfills.

The ultimate success of the organics program is dependent on whether the public will choose to participate and how accurately they separate organics, recyclables, and refuse. Actions such as improving public education, implementing fees for refuse collection, or making organics separation mandatory—as has been done for large commercial establishments in New York City and for residential collection in other cities such as San Francisco—could help motivate participation.[4] As organics presently makes up the largest portion of the refuse stream, the only route to vastly reducing the amount of waste New York City sends to landfills is by finding a way to divert greater quantities of organics away from the refuse stream.

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Endnotes

[1] IBO used a logarithmic curve because the data suggests that there is a greater increase in marginal (incremental) efficiency—as measured by tons collected per truck run—at low annual tonnage levels; as annual tonnage increases along the x-axis, efficiency continues to improve but the incremental gain in efficiency on the y-axis begins to shrink to a level that approaches a slope of zero.
[2] IBO based its $80 per ton estimate on publicly available information relating to San Francisco's compost processing, which is privatized, while factoring in inflation and truck relay costs. For further information on San Francisco composting costs, see the December 2016 report Organic Waste Processing Capacity Study For the San Francisco Bay Area Region. IBO's estimate is also in line with the per ton estimate put forward by the City of Davis Organics Processing Facility Feasibility Analysis.
[3] Total cost includes direct costs such as fuel, labor and export fees, but excludes items such as public education, administration, maintenance and interest on capital expenses.
[4] See IBO's Budget Option for implementing a Pay-As-You-Throw program.