2017

Local Law 49

Review of Voluntary Recycling Incentive Pilot Programs for NYCHA

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Kathryn Garcia Commissioner

Contents

LL49 Pilot Programs

Review of Voluntary Recycling Incentive Pilot Programs for NYCHA, per Local Law 49 (2017) (16-316.4)

Over the last three years, the New York City Department of Sanitation (DSNY) and the New York City Housing Authority (NYCHA) have entered into an historic partnership to bring NYCHA developments into compliance with the City's recycling laws for the first time and to encourage residents to recycle.

To explore options to deepen and enhance participation in the City's recycling program, the City Council passed Local Law 49 (LL49) of 2017, requiring DSNY and NYCHA to collaborate on a review of voluntary recycling incentive pilot programs to improve the diversion of designated recyclable materials in public housing.

This report summarizes the review of voluntary recycling incentive pilot programs and makes recommendations based on the findings.

Grow NYC and Green City Force at *NYCHA Recycles!* celebration

I. Recycling at NYCHA

In 2015, NYCHA and DSNY launched ***NYCHA Recycles!*** to provide unprecedented access to recycling infrastructure and training at all NYCHA developments. By December 2016, 100% of NYCHA developments had recycling bins installed, were added to DSNY recycling routes, and had at least one resident engagement event about recycling. All NYCHA households received a mailer with a recycling checklist, and all NYCHA developments received recycling decals, customized chute decals, and educational materials for distribution to residents. After the infrastructure installation was complete, DSNY and NYCHA shifted focus to staff training and resident outreach and education.

From the launch of *NYCHA Recycles!* in May 2015 through February 2018, DSNY and NYCHA have reached nearly 40,000 NYCHA residents through a variety of outreach efforts, including a multi-organization door-to-door outreach blitz with Green City Force at thirteen Mayor's Action Plan campus developments. DSNY also funds GrowNYC to operate the Environmental Ambassadors program for NYCHA residents. Environmental Ambassadors are NYCHA residents who are trained by GrowNYC to become community recycling experts. After completing two recycling workshops, Environmental Ambassadors conduct 12 hours of local outreach at their own developments to encourage their neighbors to participate in the *NYCHA Recycles!* program.

DSNY has also provided ongoing training and technical support to NYCHA staff to support their recycling and waste management efforts. DSNY conducted more than 180 trainings starting in April of 2015 for NYCHA property management and property maintenance staff, engaging more than 3,500 NYCHA personnel. These trainings include on-site work with maintenance staff directly responsible for handling waste, 3-hour workshops during incoming caretaker trainings for new employees, and managerial staff trainings for all NYCHA Property Managers and Property Maintenance Supervisors.

DSNY continues to provide additional technical support to NYCHA including site visits, regular communication to promote proper recycling setout practices, and recruitment for additional diversion programs, such as ecycleNYC. DSNY is an active participant in the NYCHA Waste Advisory Group to help NYCHA address waste issues, and develop its first ever comprehensive waste management plan.

DSNY conducted more than **180** trainings starting in April of 2015 for NYCHA property management and property maintenance staff, engaging more than **3,500** NYCHA personnel.

NYCHA Recycles! training session

II. NYCHA Waste Characterization

In 2017, DSNY's Waste Characterization Study included a baseline characterization of refuse generated by NYCHA housing developments for the first time. The study examined the composition of containerized (exterior compactor) refuse collections, which account for 85% of NYCHA households and the vast majority of NYCHA waste. The remaining NYCHA waste primarily consists of bulk waste, which is serviced by private haulers. DSNY also provides curbside collection of trash to small, scattered NYCHA developments that do not have containerized refuse collections. In addition, DSNY provides curbside recycling collections at NYCHA. Based on field observations, DSNY estimates that the current actual capture rate of recyclables from NYCHA is 1.5%.

The NYCHA sub-sort of the 2017 Waste Characterization Study found that the composition of waste at NYCHA largely mirrors Citywide trends. About 33% of NYCHA's refuse is recyclable in DSNY's curbside collections, and about 32% of NYCHA's refuse is organics suitable for composting. The study results indicate there are 47,408 tons of recyclables annually in NYCHA's containerized waste. This presents a significant opportunity to enhance participation in the City's recycling program.

The methodology and full NYCHA statistics for all sort categories (including the main material sort categories and the detailed sub-sort categories) can be viewed at **nyc.gov/wastestudy**.

Table 1: NYCHA Waste Profile from Waste Characterization Study

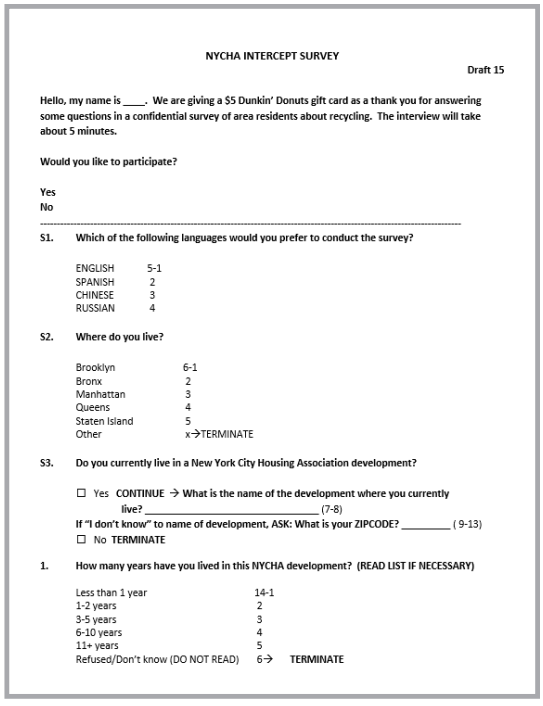
NYCHA Waste Overview	
Tons Refuse, FY2017 NYCHA containerized waste	142,365
% Recyclables, 2017 WCS NYCHA Waste Sort	33.3%
Tons Recyclables in NYCHA Refuse FY 2017	47,408
Tons Recyclables Per Household Per Year	0.32
Lbs. Recyclables Per Household Per Year	632

III. Methodology

DSNY retained the services of Henningson, Durham and Richardson, Architecture & Engineering, P.C. in association with HDR Engineering (HDR) to: engage public housing residents and other stakeholders in evaluating potential recycling incentive pilot programs; research similar programs that have been proposed or implemented in other jurisdictions; investigate the operational feasibility of implementing such programs including a cost benefit analysis of possible pilot options; and determine the steps necessary to move forward. See Appendix I for a summary of all the activities HDR and DSNY undertook to evaluate potential recycling incentive pilot programs at NYCHA.

Stakeholder Engagement

HDR conducted a baseline quantitative survey to determine NYCHA residents' attitudes and self-reported use of recycling. The survey captured a statistically significant representation of NYCHA residents' attitudes and knowledge about recycling, including various demographic subsets and the two main development types (campus, standalone/scattered). Approximately 4,156 surveys were deployed in order to capture 2,090 completed surveys, with a margin of error of +/- 3% and a confidence level of 95%. Surveys were administered in-person, via phone, and online. Additionally, each survey method was translated into the four languages prevalent in NYCHA housing (English, Spanish, Chinese, and Russian).



NYCHA INTERCEPT SURVEY

Draft 15

Hello, my name is ____. We are giving a $5 Dunkin' Donuts gift card as a thank you for answering some questions in a confidential survey of area residents about recycling. The interview will take about 5 minutes.

Would you like to participate?

Yes
No

S1. Which of the following languages would you prefer to conduct the survey?

ENGLISH	5-1
SPANISH	2
CHINESE	3
RUSSIAN	4

S2. Where do you live?

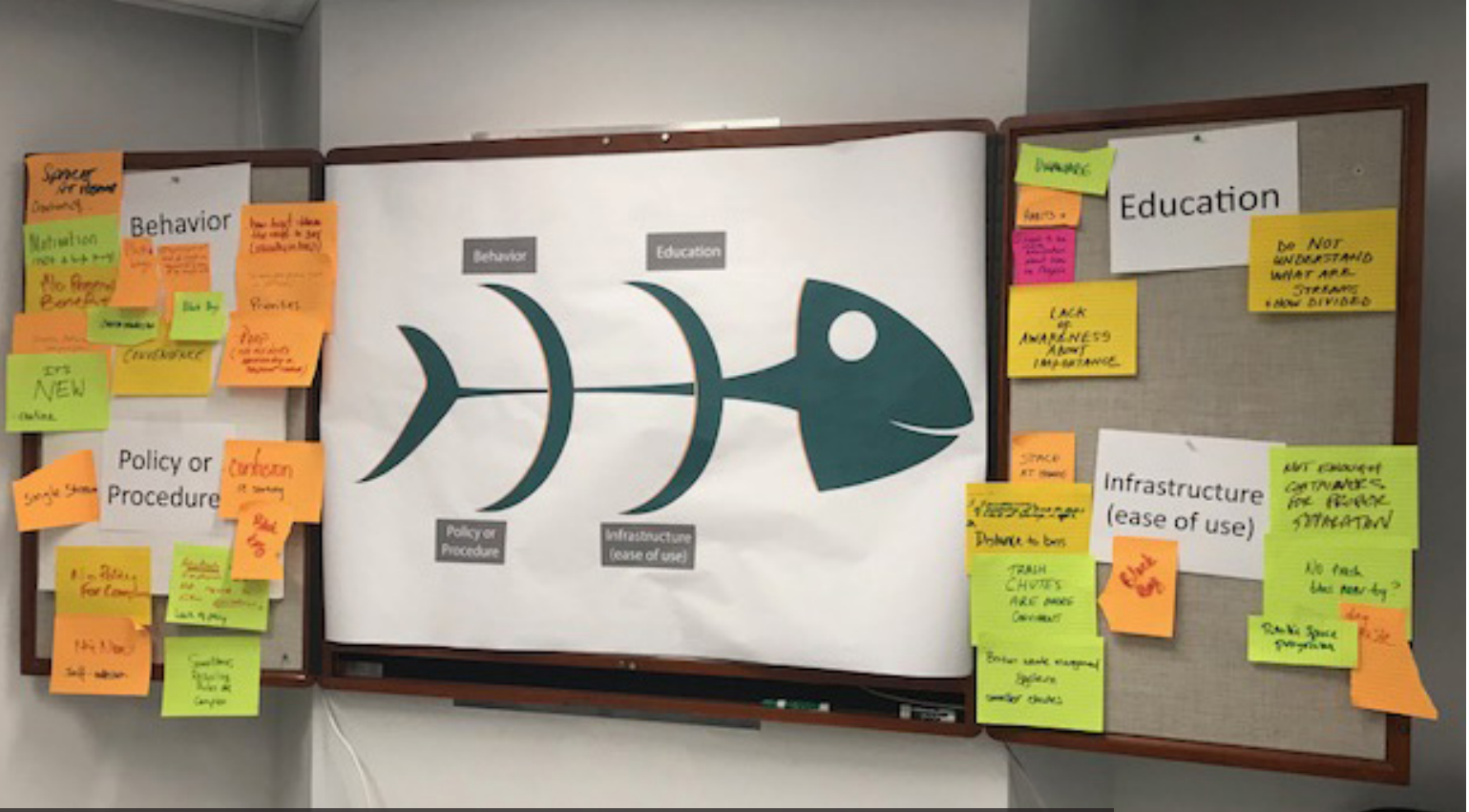
Brooklyn	6-1
Bronx	2
Manhattan	3
Queens	4
Staten Island	5
Other	x→TERMINATE

S3. Do you currently live in a New York City Housing Association development?

☐ Yes **CONTINUE → What is the name of the development where you currently live?** _____ (7-8)
If "I don't know" to name of development, ASK: What is your ZIPCODE? _____ (9-13)
☐ No **TERMINATE**

1. How many years have you lived in this NYCHA development? (READ LIST IF NECESSARY)

Less than 1 year	14-1
1-2 years	2
3-5 years	3
6-10 years	4
11+ years	5
Refused/Don't know (DO NOT READ)	6→ **TERMINATE**



Feedback board at a stakeholder meeting

Following the baseline survey, HDR convened two sets of meetings with two distinct stakeholder groups, including one group with government officials, policy makers, experts in waste management, and NYCHA staff; and one group with NYCHA residents active in their communities, and advocates interested in effecting changes at NYCHA. At the first set of stakeholder meetings, DSNY shared information on the different incentive options identified and received critical feedback on which incentives were deemed worthy of further exploration. At the second set of stakeholder meetings, the resident survey findings were shared and attendees provided input on which incentive program would be most likely to encourage residents to recycle, divert the most material, and be the overall most successful initiative.

In addition to the stakeholder meetings, focus groups were conducted with NYCHA residents to garner qualitative information on NYCHA's current recycling program and obtain feedback on the possible recycling incentive options: Monitored Bin Program, Exchange Events, and Reverse Vending Machines. For each session, the moderator asked respondents about their knowledge and use of NYCHA's current recycling program. The moderator introduced each recycling incentive option to the group and provided a written description of the program. Participants were asked to circle aspects of the program in green that they liked, and circle in red those aspects that they did not like. Once all three programs were introduced and discussed, participants were asked to vote for the program that would be most likely to motivate their neighbors to recycle and would be successful in their development. After each panelist voted for the program they felt was most likely to raise recycling rates, they were asked to rank community incentive types and also rank, high or low, how well it would motivate a NYCHA resident to recycle.

Incentive Research

HDR completed a comparative analysis of different waste and recycling incentive programs in the United States and internationally, using online research, email correspondence, and phone interviews. Incentive programs for participants, residents, and volunteers included: rewards and points incentive programs (such as the London Green Points Program), direct incentives (such as reverse vending machines, random recycling awards, and the barter market in Mexico City), mobile apps, ambassador programs, public recognition programs, city-wide challenges, and technology solutions (such as the Sorting Stations in Antwerp, Belgium). HDR also evaluated incentive programs focusing on property managers and on third parties, such as nonprofits and professional recyclers. A full description of the programs evaluated is available in **Appendix II**. The programs were grouped into 4 categories based on the incentive structure:

- Individual action leading to direct individual benefit (example: Resident receives money or coupons each time they recycle).
- Individual action that might lead to an individual benefit, but is not guaranteed. (example: "Sweepstakes" programs in which individuals get a prize if randomly observed recycling properly).
- Collective action leading to community benefit (example: If a community recycles a certain amount in a month, they receive a block party).
- Collective action leading to individual benefit (example: "Points" programs in which individuals sign up for points, and points are assigned based on the collective achievement of the development).

The four program types with representative examples were shared at the first set of stakeholder meetings. With stakeholder feedback, DSNY and NYCHA, identified three potential recycling incentive programs for further consideration and conducted a detailed implementation and cost analysis:

- Monitored Bin Program (Collective action leading to community benefit)
- Exchange Event (Individual action leading to direct individual benefit)
- Reverse Vending Machine (Individual action leading to direct individual benefit)

With stakeholder feedback, DSNY and NYCHA, identified three potential recycling incentive programs for further consideration and conducted a detailed implementation and cost analysis.

Implementation and Cost Analysis

Each of the three potential recycling incentive programs was assessed to produce a cost in dollars per ton diverted, at 5 average NYCHA buildings over a 1 year pilot program.[1] The 2013 and 2017 Waste Characterization Studies were used to determine that 5 average NYCHA buildings would produce 137.5 tons of metal, glass, plastic and paper recyclables; including 5.91 tons of redeemable deposit containers (see **Table 2**). Each program was assessed for cost in dollars per ton diverted at various potential capture rates (see **Appendix III**). This summary report highlights the cost in dollars per ton diverted at the current estimated recycling capture rate at NYCHA, 1.5%; the current citywide recycling capture rate, 51%; and 6.3%, the lowest district capture rate of 2017.

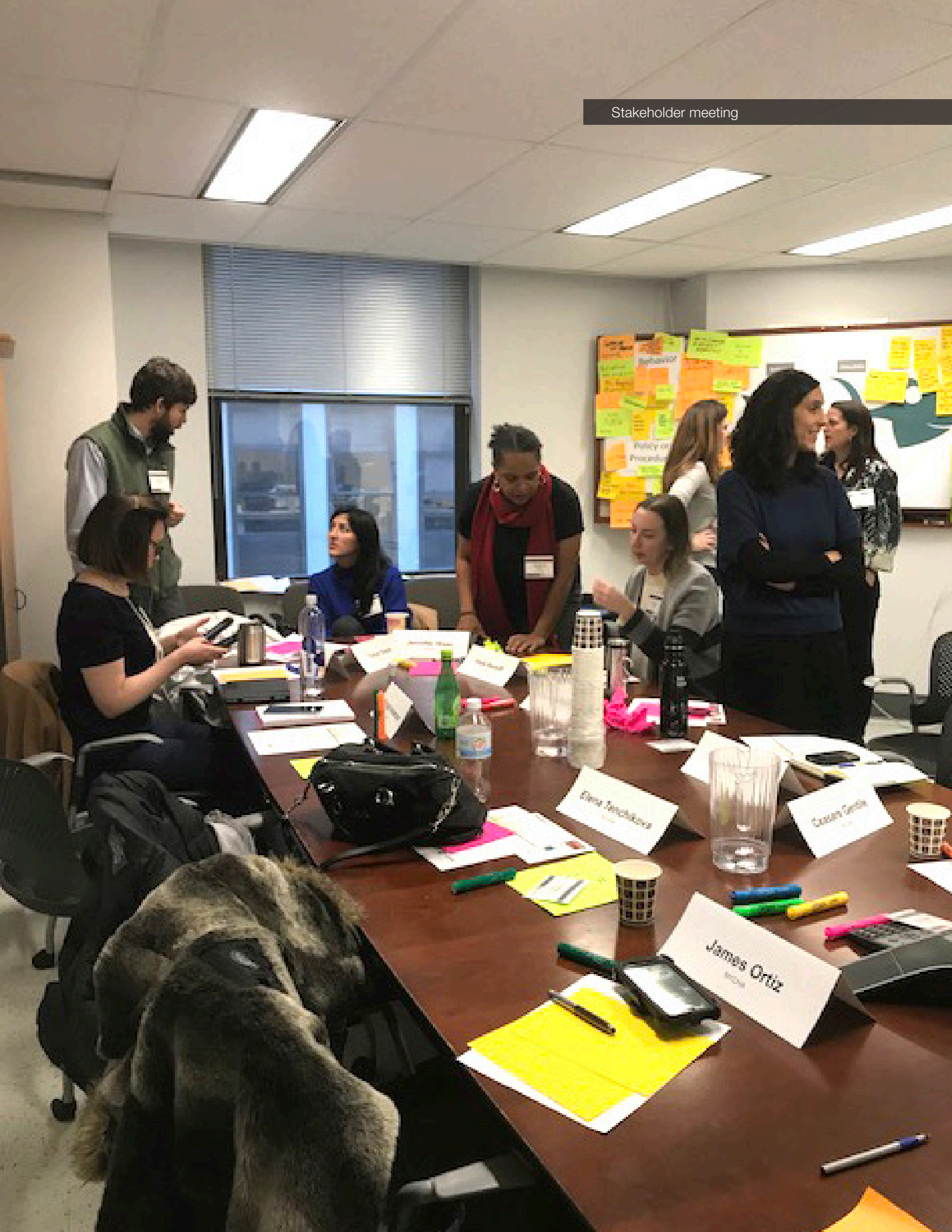
HDR assumed that the cost of implementation for each of the three potential recycling incentive programs would be similar to the costs of existing programs in other parts of the United States, Europe, and elsewhere. Costs assume use of external vendors, since neither DSNY nor NYCHA presently is able to measure point-of-pickup weights or distribute incentives using existing labor and infrastructure. In addition, HDR assumed a $5,000 outreach cost for each program to factor in baseline costs of program operation. Additional detail on the cost assumptions for each individual program is outlined below.

Finally, implementation and cost estimates do not include the costs of incentives or rewards. As several of these options require capital investment, coordination, and recycling education/promotion/outreach, there is potential for funding through state grants. Even if grants are available, with payments limited to no more than 50% of the eligible costs up to a maximum of $2 million per project, the City would be expected to fund 50%+ of the costs of the program.

Table 2: Average NYCHA Building Model

	Per Building	5 Buildings
Number Residents	201	1005
Number Households	87	435
Tons Waste	82.6	413
Tons Recyclables (Metal, Glass, Plastic and Paper)	27.5	137.5
Tons Recyclables (Deposit Containers)	1.18	5.91

1 NYCHA developments with containerized refuse service differ widely in layout and size; they range from 1 to 46 buildings, with the number of households per development anywhere from 16 to 2,193. In order to create a standard for comparison, an average NYCHA building model was created based on the NYCHA data set (Table 2). Cost estimates were based on one year of operations at 5 average NYCHA buildings.



Stakeholder meeting

IV. Findings

NYCHA Resident and Staff Engagement

The program employed a number of tactics to reach a broad range of NYCHA residents and solicit input on NYCHA's recycling program as well as on the recycling incentive options. During the course of market research and stakeholder engagement, 2,250 NYCHA stakeholders participated in either online surveys or in-person focus groups and advisory group meetings.

Ultimately, the majority of NYCHA residents understood the global and community benefits that good recycling behavior promotes. Participants felt that convenience could not be overrated and was critical to the success of any new recycling program. Key themes heard across all focus group sessions include:

- *Convenience is key.* Residents overwhelmingly focused on convenience as the number one factor, above all else, driving recycling program participation. The current program at NYCHA facilities is too complicated and requires a trip outside the building to a recycling station that may be overflowing: "Honestly, I'm not going to cart down my trash, roll it over three blocks. I'm not going to do that." It is simpler to dispose of trash via the garbage chutes in each hall than to carry recycling to a location outside.
- *Storage space is limited.* Residents agreed that storing recyclables in housing units is difficult because of space constraints and issues with insects and vermin: "To recycle if you have a small kitchen, you would need a designated area for regular garbage, and a bag for the recyclables, and there's no space for that."

Regarding incentives, participants consistently wanted to know the type and value of the incentive in order to decide if it was worth the effort to participate in the program. However, reactions among panelists were mixed with respect to whether the rewards should be individual or community-based. A slight majority of panelists preferred a community benefit over a personal reward, although there was little agreement as to what the incentive should be.

Participants felt that convenience could not be overrated and was critical to the success of any new recycling program.

GrowNYC's zero waste programs, funded by NYC Sanitation, educate NYCHA residents about recycling in NYCHA lobbies and on NYCHA grounds.

In addition, HDR conducted a baseline quantitative survey to determine NYCHA residents' attitudes and self-reported use of recycling. The survey found that:

- 78% of NYCHA residents are aware of the NYCHA recycling program.
- The majority of NYCHA residents (53%) self-reported bringing recyclable items to the recycling area every day or every other day. An additional 26% of NYCHA residents report bringing recyclables to the recycling area once a week.
- The majority of NYCHA residents (71%) thought that recycling was convenient in their home, but felt that additional space to store recyclables would be useful (53%).
- A majority of NYCHA residents (76%) felt that they did not need more information about recycling.
- NYCHA residents were asked what could be done to improve the current program. Residents could suggest more than one improvement. The most commonly suggested improvement, recommended by 37% of NYCHA residents, said that the installation of more recycling stations would improve the program.
- Most NYCHA residents (52%) ranked "more containers in more convenient locations" higher than "being rewarded or recognized" (30%) as the most effective way to motivate higher participation.

While respondents self-reported significant participation in the present recycling program, the tonnage captured does not correlate with the self-reported participation rates. Many factors account for this discrepancy, including self-reporting bias, the activity of individuals that collect redeemable bottles and cans for redemption value, misinformation about using the trash chute for recycling, and improper staff behaviors (widespread use of black bags instead of clear bags in NYCHA's recycling bins, depositing clear bags of recyclables into trash compactors, and failure to set out recyclables for weekly pickup).

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Finally, NYCHA staff also participated in the stakeholder feedback process. Key themes from these sessions include:

- Recycling programs need to be convenient for NYCHA residents.
- There is lack of interest and education in recycling programs among NYCHA residents.
- High staff turnover and lack of proper training led to low participation in previous recycling initiatives.
- Consistent messaging regarding recycling, combined with reminders or refresher meetings, would be crucial to educate residents on the importance of recycling.
- Points/cash for the direct exchange of items were the most highly valued type of incentive program; NYCHA staff also expressed value for community rewards based on community achievement.

Program Assessment: Overview

Each of the three program options — Monitored Bin Program, Exchange Event, and Reverse Vending Machines (RVMs) — has advantages and disadvantages, as outlined below. In general, feedback from all research tactics seemed to point towards RVMs as the most favored option by NYCHA residents, assuming the machines would be conveniently located and accessible 24/7. RVMs currently available in the United States only accept redeemable deposit containers, limiting the maximum tonnage of recyclables diverted to 51% or approximately 3 tons annually per 1,000 residents. The Monitored Bin program was the next most favored program, and the Exchange Events were the least favored program.

Table 3: Summary of program assessments

	Monitored Bin Program	Exchange Event	Reverse Vending
Stakeholder Feedback			
Online Survey: How successful in increasing recycling do you think this program would be in your community? (0 = unsuccessful; 10 = successful)	5.6	5.4	6.2
Focus Group: Panelists that rated this program their "Top Choice"	26%	4%	70%
Implementation and Cost Analysis (for 1 year program using Average NYCHA Building Model)			
Implementation Cost (fixed costs)	$402,298	$123,095	$11,833
Program cost in dollars per ton diverted, 1.5% capture rate	$194,950	$59,651	$132,905
Program cost in dollars per ton diverted, 6.3% capture rate	$46,417	$14,203	$31,209
Program cost in dollars per ton diverted, 51% capture rate	$5,734	$1,754	$3,355
Diversion potential, ranging from 1.5% to 51% capture rate	2.10 - 70.16 tons	2.10 - 70.16 tons	<0.1 - 3.01 tons
Implementation considerations	High tech, will require specialized equipment	Low tech, labor intensive	High tech, requires specific installation and shelter/ space

Program Assessment: Monitored Bin Program

This program would provide special bins for some recycling materials that may include metal, plastic, glass, paper and/or cardboard. The bins would be located at a development and only residents would be able to use these bins, accessed through a special key card. On a regular basis, these materials would be collected and some kind of reward would be given to the development based on the total weight of all the items recycled. For stakeholder feedback, HDR assumed that one Sorting Street Station would be installed to serve five buildings for a one year pilot program.

The monitored bin program is similar to collection containers popular in Europe. As a model, HDR evaluated Sorting Street Stations in Antwerp, Belgium, which consist of five large 6.5 cubic yard collection containers that can only be accessed by area residents using access cards (or key cards), one for each material stream: residual waste; plastic bottles, metal packaging, and drink cartons (PMD); organics; paper and cardboard; and glass. Antwerp installed its first Sorting Street Station to serve a single cluster of multifamily buildings in 2006, tested additional locations in 2007-2008 and, based on a positive public response, began widespread installation in 2009. Feedback received from the public indicated a general dislike of key cards. A keypad could be installed on the containers so that residents could just enter a code. Sorting Stations provide an economic incentive to residents who can dispose of recycling at a lower cost than trash disposal. The more residents recycle, the more money they save in waste disposal fees. As NYCHA residents do not pay direct fees to dispose of waste, the implementation of a monitored bin program at NYCHA would require development of a unique reward program. Antwerp also uses wireless Enevo sensors to monitor the fill level of the containers.

Underground bins in Antwerp, Brussels

Stakeholder and Focus Group Feedback:

- Benefits cited by participants included that a reward would be provided, that a new program might help address real waste issues, and that bins might be less full due to restricted access.
- What some participants identified as benefits were detractors for other participants. While some believed that restricted access would reduce overflow, others believed it would lead to passers-by throwing their waste on the ground instead of into the bin.
- Concerns cited by many participants included not having key cards when needed, limited access for visitors, and lost cards by children/family members. Most participants felt that a monitored bin program was inconvenient in comparison to garbage chutes and even the current recycling bins.
- Stakeholder groups thought this option presented a way to get communities to unite behind a reward for their community and that it could reduce contamination. However, the stakeholder groups also noted that many variables — such as bin location, level of community involvement, level of service, and the functionality of the actual containers — would heavily influence the program's success.

Most participants felt that a monitored bin program was inconvenient in comparison to garbage chutes and even the current recycling bins.

Cost Analysis:

- In Antwerp, municipal staff estimates that each Sorting Street Station costs approximately $93,000 to install (including all construction and container costs), with a monthly service fee of $92 per container, at the scale of citywide implementation. Estimated costs for pilot installation in New York City would be approximately $150,000, with significant additional costs for specialized collection services ($233,747), key cards ($4,500) and a maintenance contract for cleaning, battery replacement, repairs, and operation of the IT platform ($9,051). HDR estimated that implementing monitored bins at one NYCHA development with one Sorting Station serving five buildings would cost $402,298 in its first year, not including the cost of the incentives provided to residents. Infrastructure costs would decrease after initial purchases and installation. See **Appendix III** for full cost per ton diverted analysis.

Mexico City barter market

Program Assessment: Exchange Events

This program would provide regularly scheduled events at a development. Residents would be able to bring some recyclable materials that may include metal, plastic, glass, paper and/or cardboard to the event to be recycled. Only NYCHA residents would be allowed to attend. The materials would be collected and some kind of reward would be given to each resident based on the total weight of the items recycled. For stakeholder feedback, HDR assumed that all materials currently accepted in the City's recycling program would be accepted. Alternatively, the events could be structured to only accept higher value items such as PET, HDPE and aluminum, or deposit containers which would have an impact on overall diversion and event costs.

The exchange event concept is similar to the "Mercado de Trueque" or "Barter Market" in Mexico City, Mexico. An example of a similar program currently offered in New York City includes the Stop 'N' Swap program run by GrowNYC, funded by DSNY. NYCHA can build off this exchange idea by holding events like Stop 'N' Swap for its residents, but instead of swapping items, residents receive an incentive for their recyclables, coupons to local shops/grocery stores, or points to earn a reward in the future once a certain point threshold has been reached (e.g., gift card). The dropped-off recyclables would be separated and sorted by workers and volunteers.

Stakeholder and Focus Group Feedback:

- The Exchange Event concept was not well received largely because participants expressed dissatisfaction with having to save their recyclables at home for many days and up to at least one week (and were entirely opposed to longer durations between events). Based on feedback from the focus groups, most residents appeared to be unwilling to store recyclables for any length of time and preferred to dispose of their waste on a daily basis. Participants noted that this option was more inconvenient than the garbage chutes and even the current recycling bins.
- Stakeholder groups thought Exchange Events might work better for items generated in smaller quantities, such as electronic waste, textiles, or household hazardous waste. They felt that storage and transport of regular recyclables at less frequent intervals would present considerable logistical challenges that would negatively impact participation in the program. Stakeholder group participants also believed that the Exchange Event option would require a considerable behavior change from the model of recycling often using the current bins, to recycling once a week at the events, and they were concerned that requiring such a change might diminish recycling participation.

Cost Analysis:

- Using Stop 'N' Swap event costs as a baseline, HDR estimated that conducting this program via a third party such as GrowNYC at one NYCHA development (serving five buildings) with one event per week for one full year would cost $123,095 per year, not including the cost of the incentives provided to residents. No permanent installations would be required for this option. These events would be temporary in nature and only require shelter (indoors or under a tent), as well as equipment. Costs include staffing, scales, venue rental, bags, vehicle rental, tents, and promotion/education. See **Appendix III** for full cost per ton diverted analysis.

Program Assessment: Reverse Vending Machine (RVM)

This program would provide a special vending machine for some recyclable materials that may include metal, plastic, and glass. The vending machine would be located at a development. Residents would place the materials into the vending machine and some kind of reward would be given based on the number of items recycled.

Residents would place the materials into the vending machine and some kind of reward would be given based on the number of items recycled.

RVMs are seen in all parts of the world including in the United States. RVMs are more commonly seen in bottle deposit states that provide a refund for eligible beverage containers. In general, RVMs accept a single commodity, such as PET bottles, glass bottles, or aluminum cans; however, there are some that can accept two or three types of materials. RVMs are typically located near major distributors such as supermarkets or redemption centers which facilitates the redemption of vouchers. RVMs in NY do not dispense cash; instead, a voucher is dispensed which can be redeemed for cash.

Reverse Vending Machine

Stakeholder and Focus Group Feedback:

- Participants in favor of RVMs cited the 24/7 access and immediate reward as the biggest advantages to this program. Participants also felt this would be the most flexible option and that it might be located closer to their building. When asked if just one RVM per development would still be motivating, most participants expressed concerns about inconvenience and wanted the machines on each floor or at least one per building.
    - Further research on the operational considerations of these machines indicated that it may be necessary to restrict access overnight to reduce vandalism and minimize the impact of noise on nearby residents' homes. Thus, DSNY findings indicate that RVMs would not provide easier access to recycling.
- Participants were concerned that limiting RVMs to just deposit container redemption would mean that only a portion of recyclables would be accepted. If only specific recyclables were collected with the RVM, residents would need to make a second trip to manage other elements of their recycling stream, and this would make the program less convenient, a major concern cited in both the surveys and focus groups. Participants also expressed concerns about long lines forming inside developments to access the machines.
- Stakeholder groups thought that if the appropriate reverse vending technology was selected — specifically more advanced RVMs that can accept more than just deposit containers (which at this time are not yet marketed in the US) — this might be the most actionable option for NYCHA.

Cost Analysis:

- Program costs were estimated based on information provided by the two major RVM distributors, Tomra and Envipco. HDR estimated that conducting this program at one NYCHA development with one Reverse Vending Machine (serving five buildings) would cost $8,233 - $13,957 per year, depending on the model of RVM chosen, not including the cost of the incentives provided to residents. Costs include the RVM lease, receipt paper, plastic bags, and promotion/education. Revenue from NYCHA serving as the registered redemption center, with a $0.035 handling fee, split at 50% as per the lease contract, is included. It may be possible that companies could be persuaded to donate equipment and services to cover the costs of the pilot, negating the initial costs. However, the costs would continue beyond the pilot, and scaling the program to other sites would incur additional costs. Due to the popularity of RVMs in focus groups and NYCHA's interest in the technology, DSNY modeled additional scenarios for RVM implementation. Two NYCHA sites, Bushwick/Hylan and Marcy, were modeled using the same analysis as above, but with actual numbers of households and buildings, and actual FY17 containerized tonnages. See **Appendix III** for full cost per ton diverted analysis.

Revenue Analysis:

- While RVMs appear inexpensive to pilot and were popular with NYCHA residents, the upper limit for success for RVMs is capturing just 1.4% of NYCHA's total waste if 100% of deposit containers are captured NYCHA-wide. If 100% of the estimated number of deposit containers in all of NYCHA's waste are captured, and NYCHA recoups $0.018 per container, the total revenue would be $1,163,422. Eliminating all costs of outreach/education and installing one machine per 10 buildings, to give access to all 1,723 buildings with containerized service, would cost $6,833 per machine for a total of $1,177,326, for at a loss of $13,903.45. Thus, it is unlikely that NYCHA can generate revenue with a scaled up program, even if it achieves 100% success.

Table 4: RVM Revenue Analysis at Scale with 100% Capture Rate

RVM Revenue Analysis	
Capture Rate	100%
Tons	2,037
Number of Containers	64,634,580
Fixed Cost	$1,177,325.90
Gross Revenue/Year	$1,163,422.45
Cost per Ton	$578.07
Cost per Ton, after subtracting revenue from cost	$6.83
Net Revenue	-$13,903.45

Summary of Findings

Based on the information from surveys, focus groups, and stakeholder meetings, convenience cannot be overemphasized. NYCHA residents value convenience over rewards, as demonstrated in the NYCHA-wide survey. The reactions by NYCHA residents to all programs hinged on convenience (or a high level of reward). Residents expressed that they wanted any potential program conveniently located on their floor; if not on their floor, in their building; if not in their building, close to where they enter/exit. Residents want 24/7 access to any given recycling option. Residents indicated the most compelling recycling program would be one where the convenience of recycling is comparable to that of disposing trash (whether using the chute or leaving waste for custodial staff to remove). Any incentive program would have to be more convenient (both in location and in accessibility) than the current recycling stations located at NYCHA developments. The results also indicated that simply providing more containers with better signage and more frequent collection would significantly improve NYCHA's recycling program. 52% of respondents indicated "more containers and in more convenient locations" would be most effective in motivating them to recycle more, compared to the 30% of respondents who indicated "being rewarded or recognized" would be most effective.

NYCHA residents were relatively pessimistic about the success of any of the three potential program options. The Monitored Bin Program is rated at a 56% potential success rate; Exchange Events were rated at a 54% potential success rate; and Reverse Vending Machines were rated at a 62% potential chance of success. Given that none of these programs stood out to residents and all were criticized for being more inconvenient than the current recycling bins, it is unlikely that any of the efforts will reach the higher end of capture rate close to the citywide average of 51%.

Creating and funding an incentive for the program will be challenging. At this time, no funding sources have been identified by City Council as part of this Local Law. There is not a simple, effective plug-and-play incentive other than the New York State law nickel bottle deposit — and only certain containers sold in New York State are eligible for redemption. The financial value of bulk recyclables is relatively low. At a conservative estimate of $10/ton for paper recycling, a NYCHA household that recycled 100% of its 632 lbs. of recyclables could expect to receive $0.25 for fifty lbs. of paper, or $3.16 per year. Based on feedback from NYCHA residents, this dollar amount would not be motivating. Furthermore, DSNY only receives recycling revenue in favorable market conditions, so funding required for incentives would be significantly higher than the revenue the City redeems for recycling these commodities. It will take taxpayer funding to provide an incentive that will motivate residents enough to overcome the convenience factor, as well as focused staff time to source and manage that incentive, from recruiting contributors to distributing rewards. Determination of a motivating incentive would require more consultation once the level of funding has been determined. Additionally, a process for deciding on a community reward would be required, as different communities have different needs and a “one size fits all” reward may not work for all communities. Tailored reward programs will be required to provide sufficient motivation for residents to participate. It is important to reiterate that many incentive initiatives that were researched in other locales, including direct incentives from Environmental Defence Canada in Ontario, the Mayors Towering Challenge in Toronto, and another recycling awards program in North Carolina, ended after 1-5 years due to lack of ongoing funding.

At a conservative estimate of **$10**/ton for paper recycling, a NYCHA household that recycled **100%** of its **632** lbs. of recyclables could expect to receive **$0.25** for fifty lbs. of paper, or **$3.16** per year.

Any of the potential programs would have to be customized to fit the individual site, given the variety of housing within NYCHA and varied space availability. In some cases, certain NYCHA developments may not be able to have access to the incentive program due to physical space limitations.

Conclusion

In 2016, DSNY and NYCHA achieved our goal of making recycling available to every NYCHA resident. Over the last three years, through various programs and in a multitude of forums, we have together engaged more than 40,000 NYCHA residents about the importance of recycling.

Last year, the New York City Council passed Local Law 49, which required DSNY to evaluate potential voluntary incentive pilot programs to improve diversion of designated recyclables in public housing. After conducting extensive research, surveys, analysis, and focus groups, DSNY has determined that voluntary recycling incentive programs are unlikely to be feasible on a large scale in a cost-effective manner and are unlikely to significantly improve diversion of designated recyclable materials in public housing. NYCHA residents value convenience over rewards; the investigated programs are less convenient than the existing NYCHA recycling program, and the costs for program implementation, not including incentive costs, are high.

Of the three potential programs analyzed, reverse vending machines offer the most promise. This option would take advantage of existing incentives in the New York State Bottle Bill to offset overall costs. If the City Council is interested in funding a pilot recycling incentive program, DSNY would recommend a limited scale Reverse Vending Machine program. Such a pilot will need to maximize the convenience of the machines, and use advanced RVMs that can accept more than just deposit containers, if possible. DSNY and NYCHA would work together to identify a location acceptable to residents and install the ideal number of machines for the pilot development. However, given our substantial research and surveys, DSNY does not recommend implementing a voluntary recycling incentive pilot that does not improve upon the convenience of the existing recycling program.

Appendix I

Research and Engagement Deliverables

Research

Conducted comparative research on existing recycling incentive programs.

Research & Engagement

Conducted a baseline quantitative assessment of NYCHA residents' attitudes toward recycling. The survey produced statistically significant results for key demographics and NYCHA development types ("campus" and "scattered").

Analysis

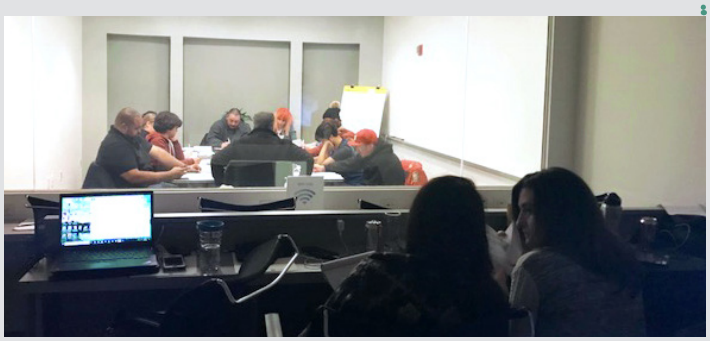
Identified up to three recycling incentive program options for further consideration.

Engagement

Conducted Stakeholder Advisory Group Meetings with NYCHA "advocate" audience and with "expert" audience. Two sets of meetings were conducted with each group.

Engagement

Conducted 5 focus groups to get feedback about the recycling incentive options from NYCHA residents and implementation staff.



Research & Engagement

Conducted an online survey to get feedback from NYCHA residents about the recycling incentive options.

Research

Conducted additional research to identify mechanism to implement and support recycling incentive programs.

Analysis

Ranked and evaluated feasibility and likelihood of success of preferred options.

Appendix II

Incentive Programs Researched and Evaluated

Incentive Name	Program Description
Recyclebank Points Program	Through an online recycling app, residents can report when they recycle to receive points. The points rewarded can be redeemed for gifts, such as magazine subscriptions, gift cards, and discounts at certain retailers. Points can also be donated to charities and schools and can be used to enter contests. Retail stores and other companies can participate in the program to provide discounts through Recyclebank, in return for advertising.
Green Points Program, London, England	Weight data for waste and recyclables is collected by a private hauler who reports tonnage data to the Local Councils. Local Councils submit the data to the Waste Minimization and Recycling Officer. Points are awarded to communities by the Waste Minimization and Recycling Officer based on the amount they recycled as a whole. The points go directly to resident accounts and membership cards and can be used to access discounts at participating retailers.
Reverse Vending Machines (RVMs)	Reverse Vending Machines (RVMs) are machines that accept recyclable containers, such as polyethylene terephthalate (PET) plastic bottles, glass bottles, and aluminum cans, and in return, provide rewards such as a bottle deposit, gift cards, credit to grocery stores, and more. RVMs are seen in all parts of the world including in the United States. Brief examples of programs in California, Oregon, New York, and Boston are described in the report.
Random Recycling Awards, Archdale, NC	Every month Archdale staff randomly conducted an audit of residents' recycling bins and a $100 reward was provided to the participating household if there was little to no contamination in the bins.
"Get Caught Green Handed" Charlotte, NC	For 3 months, an undercover prize patrol would monitor new recycling bins. The prize control would 'catch' and subsequently reward people who were using the new bins properly. In the 3 month time span, a total of 288 people were rewarded.
Cash Incentives for Recycling Ontario, Canada	Environmental Defence Canada (EDC) organized a series of three bottle collection events around the Greater Toronto Area to raise awareness about deposit return programs for beverage containers. Plastic bottles 1 liter (33 oz) or less were accepted and participants were given $0.10 for each bottle.

Incentive Name	Program Description
'Mercado de Trueque' or 'Barter Market' in Mexico City	Residents drop off recyclables at a 'green point' collection site held once a month in a city park. The waste is source separated and weighed by government employees and volunteers. Residents are then given vouchers, which can be exchanged at a local farmers market. The value of the points received varies with the value of the products that the recycling company will pay for the materials. Points provided vary according to the type of material being recycled, with PET being the most valuable, followed by aluminum cans, cartons, paper/cardboard, and then glass. Recently, waste electronics are being accepted. There is a limit of 200 points per person per day.
"Happen" Mobile app, Charlotte, NC	Users earn points by sharing their sustainable actions through the 'Happen' app to Facebook. Similarly, users can tweet or post a photo of themselves and colleagues taking action to save energy around the office. They earn points by using the hashtag '#myenergychallenge' on Twitter (@DE_SmartEnergy; 1,347 followers). A happy hour is offered to honor top-performing locations monthly.
3Rs Ambassador Program, Toronto, Canada	The 3R Ambassadors Program run by Toronto Solid Waste Management Services recruits volunteers from apartment buildings around the city and trains them to educate residents in their own buildings. A Building Spotlight Competition has been put in place every quarter for volunteers to win a $25 gift card. This competition can involve building set-up, and reduce and reuse programming and education. Volunteers are judged on their creativity, outreach, engagement, sustainability, and other considerations. Volunteer credits can be earned by high school students (students are required to have 40 hours of volunteer time in order to graduate).
Friends of Recycling and Composting (FORC), Seattle, WA	FORC is an organization for multi-family buildings to promote recycling and food waste collection in the City of Seattle. FORC volunteers can sign up online or over the phone through Seattle Public Utilities (SPU). They can be a manager, resident, or facility staff person and can volunteer as long as they are on site at least once per week. Volunteers receive a one-time $100 utility credit and receive free compost containers for their building's residents along with educational materials and posters.
Recycling Achievement Recognition Program, Montgomery County, MD	Montgomery County recognizes property managers and individuals for going above and beyond with recycling and creating initiatives. These recognition programs work to show other people that they "can do it too." There are no direct financial incentives to recycle in Montgomery County. Award winners receive recognition and are placed on the Montgomery County website. Volunteer work is solely for personal interest by people who care about protecting the environment and teaching others about the importance of recycling.

Incentive Name	Program Description
Mayor's Towering Challenge/Citywide Apartment Recycling Recognition Program, Toronto, Canada	In 2016, the City of Toronto launched the Mayor's Towering Challenge to increase waste reduction and recycling rates. The Challenge was aimed to motivate Property Managers, Superintendents, Owners, Boards, 3Rs Ambassadors, and residents to take an active role and help the city achieve its waste diversion rate goal of 70% by 2026. Participants were required to keep track of the number of garbage, recycling, and organics bins set out on each collection day for the duration of the challenge. For those buildings with front end bins, either the City provided lift data or those participants with private collection were required to provide proof of lift data from their service provider. The challenge was open to any building with nine or more units. Non-City customers were also encouraged to participate. An independent judging committee reviewed and scored the submissions based on criteria provided by Solid Waste Management Services. The building with the most points was designated the winner and got recognized at an award ceremony with the Mayor.
Sorting Street Stations, Antwerp, Belgium	Antwerp has begun installing underground collection containers that can only be accessed by area residents using an access card linked to a unique pre-paid account. Each time residents access the containers, they are charged a volume-based fee for residual waste, and a lower fee for plastic and metal containers and cartons. Containers for paper, glass, and organics can be accessed for free. The incentive related to this option is a lower fee to dispose of divertible materials.
Property Managers Recognition Best Practices and Score Card, Seattle, WA	Seattle Housing Authority determined that the most effective way of increasing recycling participation was to focus on property managers instead of residents. They determined that if residents had access to appropriate infrastructure, they would sort appropriately. They worked to establish trust between the hauler and the property manager. Property managers are recognized publicly in a bi-monthly meeting and/or via a public virtual "pat-on-the-back" system though their internal intranet site, based on their program improvement at the management level.
Binners' Project, Vancouver, Canada	The Binners' Project supports local binners, people who collect bottles to redeem a bottle deposit. The deposit in Vancouver ranges from $0.05 to $0.20 per bottle. Binners usually work alone and they bring collected bottles to a bottle depot to receive cash.

Incentive Name	Program Description
Green Streets, San Francisco, CA	In San Francisco, property managers can be charged for contamination (recyclable or compostable materials in the trash or trash in the recycling or compost). The fines can be significant — a doubling of their garbage bill. Property managers pay Green Street staff to clean up the materials so that the buildings are in compliance with the City's mandatory recycling ordinance. Green Street staff are residents in low income housing who are taught and paid to provide a wide range of janitorial services, including making operational corrections to ensure that the materials are properly sorted and preparing the carts and bins for collection by service provider.

Appendix III

DISCLAIMER: COST RESULTS ILLUSTRATED IN ANY OF THESE TABLES MAY NOT PROVIDE THE EXACT SAME CALCULATIONS, DUE TO ROUNDING.

Monitored Bin: Sensitivity Analysis

Capture Rate	Annual Tonnage at 5 Average NYCHA Buildings	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost
1%	1.3757	$402,298	$0	$292,425	$292,425
1.5%	2.0636	$402,298	$0	$194,950	$194,950
5%	6.879	$402,298	$0	$58,485	$58,485
6.3%	8.667	$402,298	$0	$46,417	$46,417
10%	13.757	$402,298	$0	$29,243	$29,243
15%	20.64	$402,298	$0	$19,495	$19,495
20%	27.51	$402,298	$0	$14,621	$14,621
25%	34.39	$402,298	$0	$11,697	$11,697
30%	41.27	$402,298	$0	$9,748	$9,748
35%	48.15	$402,298	$0	$8,355	$8,355
40%	55.03	$402,298	$0	$7,311	$7,311
45%	61.91	$402,298	$0	$6,498	$6,498
50%	68.79	$402,298	$0	$5,849	$5,849
51%	70.16	$402,298	$0	$5,734	$5,734
55%	75.67	$402,298	$0	$5,317	$5,317
60%	82.54	$402,298	$0	$4,874	$4,874
65%	89.42	$402,298	$0	$4,499	$4,499
70%	96.30	$402,298	$0	$4,178	$4,178
75%	103.18	$402,298	$0	$3,899	$3,899
80%	110.06	$402,298	$0	$3,655	$3,655

Capture Rate	Annual Tonnage at 5 Average NYCHA Buildings	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost
85%	116.94	$402,298	$0	$3,440	$3,440
90%	123.82	$402,298	$0	$3,249	$3,249
95%	130.69	$402,298	$0	$3,078	$3,078
100%	137.57	$402,298	$0	$2,924	$2,924

Exchange Event: Sensitivity Analysis

Capture Rate	Annual Tonnage at 5 Average NYCHA Buildings	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost
1%	1.3757	$123,095	$0	$89,476	$89,476
1.5%	2.0636	$123,095	$0	$59,651	$59,651
5%	6.88	$123,095	$0	$17,895	$17,895
6.3%	8.67	$123,095	$0	$14,203	$14,203
10%	13.76	$123,095	$0	$8,948	$8,948
15%	20.64	$123,095	$0	$5,965	$5,965
20%	27.51	$123,095	$0	$4,474	$4,474
25%	34.39	$123,095	$0	$3,579	$3,579
30%	41.27	$123,095	$0	$2,983	$2,983
35%	48.15	$123,095	$0	$2,556	$2,556
40%	55.03	$123,095	$0	$2,237	$2,237
45%	61.91	$123,095	$0	$1,988	$1,988
50%	68.79	$123,095	$0	$1,790	$1,790
51%	70.16	$123,095	$0	$1,754	$1,754
55%	75.67	$123,095	$0	$1,627	$1,627
60%	82.54	$123,095	$0	$1,491	$1,491
65%	89.42	$123,095	$0	$1,377	$1,377
70%	96.30	$123,095	$0	$1,278	$1,278
75%	103.18	$123,095	$0	$1,193	$1,193
80%	110.06	$123,095	$0	$1,118	$1,118
85%	116.94	$123,095	$0	$1,053	$1,053
90%	123.82	$123,095	$0	$994	$994
95%	130.69	$123,095	$0	$942	$942
100%	137.57	$123,095	$0	$895	$895

Reverse Vending Machine: Sensitivity Analysis

Capture Rate	Annual Tonnage of Deposit Containers at 5 Average NYCHA Buildings	Number of Deposit Containers Captured	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost	Net Revenue
1%	0.05910	1,876	$11,833	$34	$200,215	$199,644	-$11,799
1.5%	0.08865	2,813	$11,833	$51	$133,477	$132,905	-$11,782
5%	0.2955	9,378	$11,833	$169	$40,043	$39,472	-$11,664
6.3%	0.3723	11,817	$11,833	$213	$31,780	$31,209	-$11,620
10%	0.5910	18,756	$11,833	$338	$20,021	$19,450	-$11,495
15%	0.8865	28,135	$11,833	$506	$13,348	$12,776	-$11,327
20%	1.182	37,513	$11,833	$675	$10,011	$9,439	-$11,158
25%	1.478	46,891	$11,833	$844	$8,009	$7,437	-$10,989
30%	1.773	56,269	$11,833	$1,013	$6,674	$6,103	-$10,820
35%	2.069	65,647	$11,833	$1,182	$5,720	$5,149	-$10,651
40%	2.364	75,026	$11,833	$1,350	$5,005	$4,434	-$10,483
45%	2.660	84,404	$11,833	$1,519	$4,449	$3,878	-$10,314
50%	2.955	93,782	$11,833	$1,688	$4,004	$3,433	-$10,145
51%	3.014	95,658	$11,833	$1,722	$3,926	$3,355	-$10,111
55%	3.25	103,160	$11,833	$1,857	$3,640	$3,069	-$9,976
60%	3.55	112,538	$11,833	$2,026	$3,337	$2,766	-$9,807
65%	3.84	121,917	$11,833	$2,194	$3,080	$2,509	-$9,639
70%	4.14	131,295	$11,833	$2,363	$2,860	$2,289	-$9,470
75%	4.43	140,673	$11,833	$2,532	$2,670	$2,098	-$9,301
80%	4.73	150,051	$11,833	$2,701	$2,503	$1,931	-$9,132
85%	5.02	159,429	$11,833	$2,870	$2,355	$1,784	-$8,963
90%	5.32	168,808	$11,833	$3,039	$2,225	$1,653	-$8,794
95%	5.61	178,186	$11,833	$3,207	$2,108	$1,536	-$8,626
100%	5.91	187,564	$11,833	$3,376	$2,002	$1,431	-$8,457

Reverse Vending Machine: Sensitivity Analysis for Bushwick Houses (assumes 1 RVM per 9 buildings)

Bushwick Houses	
Buildings	9
Households	1,220
Actual FY17 Refuse Tonnage	1,357.52
Deposit Container Tonnage in Bushwick Waste	19.41

Capture Rate	Annual Tonnage of Deposit Containers	Number of Deposit Containers Captured	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost	Net Revenue
1%	0.1941	6,161	$11,833.00	$110.89	$60,955.46	$60,384.21	-$11,722.11
1.5%	0.2912	9,241	$11,833.00	$166.34	$40,636.97	$40,065.72	-$11,666.66
5%	0.9706	30,804	$11,833.00	$554.47	$12,191.09	$11,619.84	-$11,278.53
6.3%	1.2230	38,813	$11,833.00	$698.63	$9,675.47	$9,104.22	-$11,134.37
10%	1.9413	61,607	$11,833.00	$1,108.93	$6,095.55	$5,524.30	-$10,724.07
15%	2.9119	92,411	$11,833.00	$1,663.40	$4,063.70	$3,492.45	-$10,169.60
20%	3.8825	123,215	$11,833.00	$2,217.87	$3,047.77	$2,476.53	-$9,615.13
25%	4.8531	154,019	$11,833.00	$2,772.34	$2,438.22	$1,866.97	-$9,060.66
30%	5.8238	184,822	$11,833.00	$3,326.80	$2,031.85	$1,460.60	-$8,506.20
35%	6.7944	215,626	$11,833.00	$3,881.27	$1,741.58	$1,170.34	-$7,951.73
40%	7.7650	246,430	$11,833.00	$4,435.74	$1,523.89	$952.64	-$7,397.26
45%	8.7356	277,234	$11,833.00	$4,990.21	$1,354.57	$783.32	-$6,842.79
50%	9.7063	308,037	$11,833.00	$5,544.67	$1,219.11	$647.86	-$6,288.33
51%	9.9004	314,198	$11,833.00	$5,655.57	$1,195.21	$623.96	-$6,177.43
55%	10.6769	338,841	$11,833.00	$6,099.14	$1,108.28	$537.03	-$5,733.86
60%	11.6475	369,645	$11,833.00	$6,653.61	$1,015.92	$444.68	-$5,179.39
65%	12.6181	400,449	$11,833.00	$7,208.07	$937.78	$366.53	-$4,624.93
70%	13.5888	431,252	$11,833.00	$7,762.54	$870.79	$299.55	-$4,070.46

Capture Rate	Annual Tonnage of Deposit Containers	Number of Deposit Containers Captured	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost	Net Revenue
75%	14.5594	462,056	$11,833.00	$8,317.01	$812.74	$241.49	-$3,515.99
80%	15.5300	492,860	$11,833.00	$8,871.48	$761.94	$190.70	-$2,961.52
85%	16.5007	523,664	$11,833.00	$9,425.94	$717.12	$145.88	-$2,407.06
90%	17.4713	554,467	$11,833.00	$9,980.41	$677.28	$106.04	-$1,852.59
95%	18.4419	585,271	$11,833.00	$10,534.88	$641.64	$70.39	-$1,298.12
100%	19.4125	616,075	$11,833.00	$11,089.35	$609.55	$38.31	-$743.65

Reverse Vending Machine: Sensitivity Analysis for Marcy Houses (assumes 1 RVM per 27 buildings)

Marcy Houses	
Buildings	27
Households	1,714
Actual FY17 Refuse Tonnage	1,798.67
Deposit Container Tonnage in Bushwick Waste	25.720981

Capture Rate	Annual Tonnage of Deposit Containers	Number of Deposit Containers Captured	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost	Net Revenue
1%	0.2572	8,163	$11,833.00	$146.93	$46,005.24	$45,434.00	-$11,686.07
1.5%	0.3858	12,244	$11,833.00	$220.40	$30,670.16	$30,098.92	-$11,612.60
5%	1.2860	40,814	$11,833.00	$734.65	$9,201.05	$8,629.80	-$11,098.35
6.3%	1.6204	51,426	$11,833.00	$925.66	$7,302.42	$6,731.17	-$10,907.34
10%	2.5721	81,628	$11,833.00	$1,469.30	$4,600.52	$4,029.28	-$10,363.70
15%	3.8581	122,442	$11,833.00	$2,203.95	$3,067.02	$2,495.77	-$9,629.05
20%	5.1442	163,256	$11,833.00	$2,938.60	$2,300.26	$1,729.02	-$8,894.40
25%	6.4302	204,070	$11,833.00	$3,673.26	$1,840.21	$1,268.96	-$8,159.74
30%	7.7163	244,884	$11,833.00	$4,407.91	$1,533.51	$962.26	-$7,425.09
35%	9.0023	285,698	$11,833.00	$5,142.56	$1,314.44	$743.19	-$6,690.44
40%	10.2884	326,512	$11,833.00	$5,877.21	$1,150.13	$578.88	-$5,955.79
45%	11.5744	367,326	$11,833.00	$6,611.86	$1,022.34	$451.09	-$5,221.14
50%	12.8605	408,140	$11,833.00	$7,346.51	$920.10	$348.86	-$4,486.49
51%	13.1177	416,302	$11,833.00	$7,493.44	$902.06	$330.82	-$4,339.56
55%	14.1465	448,953	$11,833.00	$8,081.16	$836.46	$265.21	-$3,751.84
60%	15.4326	489,767	$11,833.00	$8,815.81	$766.75	$195.51	-$3,017.19
65%	16.7186	530,581	$11,833.00	$9,550.47	$707.77	$136.53	-$2,282.53
70%	18.0047	571,395	$11,833.00	$10,285.12	$657.22	$85.97	-$1,547.88

Capture Rate	Annual Tonnage of Deposit Containers	Number of Deposit Containers Captured	Estimated Annual Cost of Pilot	Revenue/ Year	Cost per Ton/Year	Cost per Ton, After Subtracting Revenue from Cost	Net Revenue
75%	19.2907	612,209	$11,833.00	$11,019.77	$613.40	$42.16	-$813.23
80%	20.5768	653,023	$11,833.00	$11,754.42	$575.07	$3.82	-$78.58
85%	21.8628	693,837	$11,833.00	$12,489.07	$541.24	-$30.01	$656.07
90%	23.1489	734,651	$11,833.00	$13,223.72	$511.17	-$60.08	$1,390.72
95%	24.4349	775,465	$11,833.00	$13,958.37	$484.27	-$86.98	$2,125.37
100%	25.7210	816,279	$11,833.00	$14,693.02	$460.05	-$111.19	$2,860.02

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Kathryn Garcia Commissioner

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