

NYCHA 2.0 Clean Fleet Plan



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The NYCHA 2.0 Clean Fleet Plan is a long-term agenda that aligns NYCHA's fleet management with the goals of New York City and reduces NYCHA's vehicle-related carbon emissions by 40% by 2028.

In December 2015, New York City launched a multi-agency fleet sustainability plan, [NYC Clean Fleet](#), to aggressively cut emissions from its 29,000-unit fleet while ensuring agencies can meet their vital operational needs. With NYC Clean Fleet, New York City aims to lead by example and catalyze the broader adoption of clean, renewable, and zero-emission solutions by private fleets and other government fleets that operate in the City. New York City has committed to adding 2,000 electric vehicles (EVs) to its municipal vehicle fleet by 2025, which would constitute the largest EV fleet of any U.S. city. NYC Clean Fleet also seeks to reduce greenhouse gas (GHG) emissions from its fleet operations 50% below 2005 levels by 2025 and 80% below 2005 levels by 2035 – equivalent to decommissioning a 65 MW coal power plant in the city or planting 6,000 trees.

In 2018, NYCHA joined the interagency NYC Fleet, which oversees the NYCHA Clean Fleet plan, to consolidate fleet management services. Under this agreement, NYCHA continues to pay for vehicles, parts, and fuel but can utilize DCAS contracts and participate in other NYC Fleet initiatives such as car- and EV charging station sharing. Among the city agencies that have joined NYC Fleet, NYCHA's fleet of 915 vehicles is the fourth smallest.

Like NYC Clean Fleet, the NYCHA Clean Fleet Plan outlines a long-term transition to electric vehicles and near-term actions to support best practices in clean fleet management:

Transition to Electric Vehicles

1. Purchase EVs when replacing sedans and SUVs.

Price-competitive EV sedans and SUVs are already available on the market. Starting 2019, NYCHA will purchase EVs when replacing sedans and SUVs.

Local Law 28 of 2005 requires that NYC Fleet purchase the most fuel-efficient vehicles for light- and medium-duty non-emergency units. As a member of NYC Fleet, new sedans and SUVs purchased by NYCHA must be hybrid, plug-in hybrid, or all electric models. Sedans and SUVs make up 22% of NYCHA's fleet. More than half of these sedans are already hybrid vehicles. Replacing the remaining sedans and SUVs with EVs will result in electrification of 18% of the NYCHA fleet.

2. Replace pick-up trucks with EV trucks.

Light-duty and medium-duty pick-up trucks make up 37% of the NYCHA fleet. Where possible and economic, NYCHA will replace pick-up trucks with EV trucks. NYCHA has already purchased six EV trucks to test their utility, durability, and ease of maintenance.

3. Secure access to EV charging infrastructure.

A transition to EVs requires access to charging infrastructure. NYCHA's current EV charging facilities consist of one level 2 charger at the Long Island City office location, one level 2 solar car port at Smith Houses, and three dual port level 2 chargers at Fleet Services at 23 Ash Street.

NYCHA will negotiate access to the 500 EV charging stations installed by DCAS while evaluating opportunities and costs of installing charging infrastructure on NYCHA properties.

4. Replace diesel with biodiesel for heavy- and medium-duty vehicles.

Most vehicles that do not have EV replacement models available as of 2019 use diesel. Diesel vehicle operation accounts for approximately 14% of NYCHA's annual GHG emissions (700 short tons of CO₂). On a per gallon basis, diesel emits more greenhouse gases than gasoline: 22.4 pounds of CO₂ vs. 19.6 pounds of CO₂.

The City has over 400 independent biodiesel fueling sites and NYC Fleet seeks to replace diesel with biodiesel and renewable diesel in the short- term. Biodiesel is a renewable alternative to traditional diesel made from oils and recycled cooking grease. Renewable diesel is created from plant products and animal fats. Replacing diesel fuel with biodiesel or renewable diesel can reduce emissions by up to 75%.

NYCHA's fleet does not currently use biodiesel or renewable diesel. Because no changes to the vehicle are required to use biodiesel or renewable diesel, NYCHA can easily convert from diesel to biodiesel and renewable diesel by negotiating access to the City's biodiesel fueling sites.

5. Monitor technology and market developments.

Technology for EVs and EV infrastructure is changing quickly. NYCHA will monitor the availability of new vehicles and charging technology to identify future opportunities to move more quickly toward a low-carbon fleet.

Clean Fleet Management Best Practices

1. Track GHG emissions.

In 2017, NYCHA's vehicle operations accounted for approximately 5,055 short tons of CO₂. NYCHA will institute procedures to track vehicle-related GHG emissions on an annual basis.

2. Right-size fleet by identifying under-used and unused vehicles

In 2018, nearly all NYCHA vehicles (903 out of 915) were equipped with telematics devices that connect via cellular network to Geotab, an online platform that allows users to track vehicle movements and other information including routes, miles travelled, idling time, fuel usage, etc. Using this data, NYCHA will identify underused and unused vehicles to adjust vehicle assignments so that the over-all size of the fleet matches the Authority's needs.

3. Manage fleet composition

NYCHA will conduct a review of fleet utilization to identify opportunities to downsize vehicles to the most efficient vehicle that meets the needs of NYCHA drivers. For example, downsizing from a gas SUV to an EV sedan saves money and reduces GHGs.

4. Expand car sharing

NYC Fleet has two car sharing programs: Car Share and Fleet Share ("Local Motion"). The Car Share program provides NYC Fleet members, including NYCHA, discounted weekday access to Zipcars that are also available to the general public. Local Motion, on the other hand, uses Zipcar technology in City-owned vehicles and is open only to NYC Fleet members. The Local Motion

fleet includes 50 all electric GM Chevy Bolts. In addition to participating in City-wide Local Motion, NYCHA is developing a NYCHA-only car sharing program using the Local Motion hardware and software. The NYCHA car sharing program will allow NYCHA departments to better utilize some 100 Authority-owned vehicles that are currently sitting idle for the majority of the day.

About NYCHA Fleet Services

NYCHA Fleet is led by Joseph LaMarca, Director of General Services, under the leadership of Kerri Jew, Executive Vice President for Administration and Chief Administrative Officer. NYCHA Fleet manages a fleet of 915 on-road vehicles and approximately 1500 pieces of horticultural equipment— motorized equipment that staff members can ride. Fleet Services receives an annual budget of \$3 million dollars for replacement of these vehicles and equipment. NYCHA Fleet also operates a Vehicle Repair Shop (VRS) at 23 Ash Street in Greenpoint, Brooklyn. VRS does 90% of all horticultural repairs on site and administers the service contract for on-road vehicles from this site. General Services manages an operating budget of approximately \$7 million dollars for servicing on-road vehicles, purchasing parts and supplies for all motorized equipment, fueling of all motorized equipment, and monitoring of the on-road vehicles' Telematics GPS devices.

Acknowledgments

NYCHA thanks Climate Corps fellows Jessica Kaliski (NYU) and Sabah Usmani (MIT). Their analysis and recommendations are reflected in this plan. NYCHA also thanks the staff and supporters of the Environmental Defense Fund's Climate Corps Fellowship program.

The partnership of NYC DCAS Fleet Services team led by Keith Kerman, Chief Fleet Officer and Deputy Commissioner of DCAS, was also integral to the development of this plan.

APPENDIX

EDF Climate Corps Clean Fleet Assessment Findings

Over the summer of 2018, NYCHA engaged Environmental Defense Fund’s Climate Corps program to analyze NYCHA’s clean fleet needs and opportunities. Climate Corps fellows Jessica Kaliski (NYU) and Sabah Usmani (MIT) conducted interviews and data analysis over 10 weeks to develop recommendations for the NYCHA 2.0 Clean Fleet Plan.

EDF Climate Corps is fellowship program that cultivates the next generation of sustainability professionals while helping organizations meet their sustainability and energy goals. NYCHA has regularly hosted one or more Climate Corps fellows since 2011. More information about EDF Climate Corps is available at <http://edfclimatecorps.org>.

Summary of Recommendations

The primary objective of this project is to provide NYCHA with a ten-year roadmap of strategic steps and recommendations to reduce GHG emissions from its fleet of 900+ on-road vehicles. To fulfill the Authority’s objectives – to create healthy and comfortable homes that will withstand the challenges of climate change – and to comply with the OneNYC’s broader goals of reducing GHG emissions from transportation, we recommend that NYCHA take a three-pronged approach: Reduce, Replace, and Electrify:

Reduce

- Eliminate underused and unused vehicles
- Introduce car-sharing systems within NYCHA and across City Agencies

Replace

- Replace aging vehicles with hybrids, plug-in hybrids, and electric vehicles
- Substitute to low emission fuel options (such as biodiesel and renewable diesel)

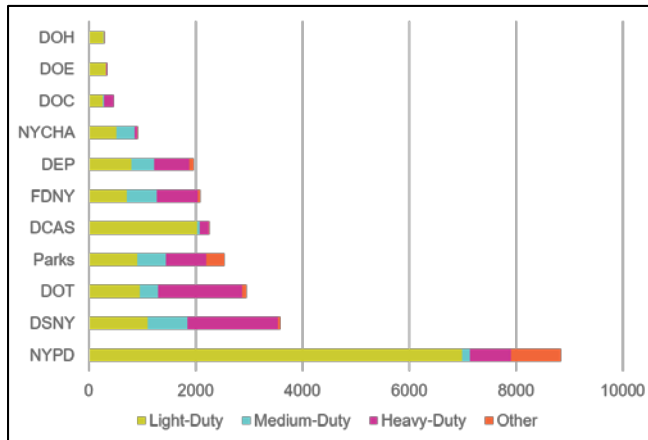
Electrify

- Utilize DCAS’s existing electric vehicle (EV) infrastructure
- Extend EV infrastructure in NYCHA properties (for NYCHA employees, residents, and the public)

Part 1: The NYCHA Fleet

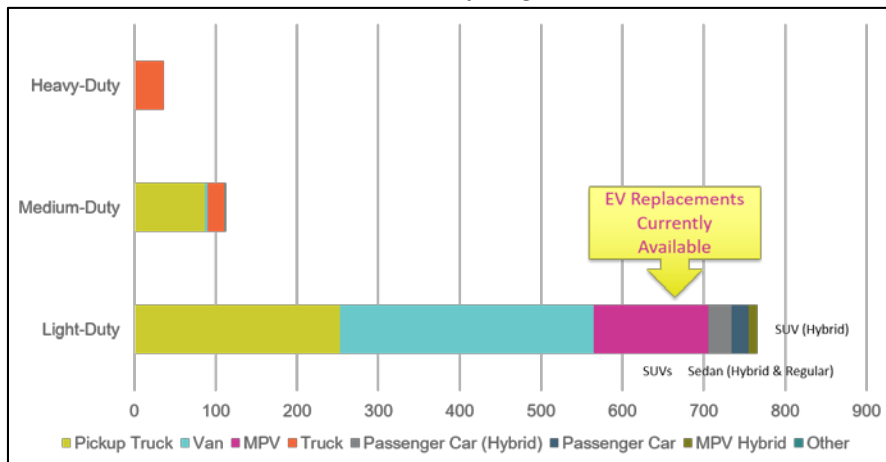
The NYC Clean Fleet operates over 29,000 fleet units, including 1,200 EV units. NYCHA’s fleet, in comparison, includes 915 on-road vehicles, composed of light- (84%), medium- (12%), and heavy-duty (4%) vehicles. Among the primary city agencies within the Fleet Federation, this makes NYCHA the fourth smallest in terms of fleet size.

Vehicle Composition by Fleet Federation Agency



NYCHA’s light-duty vehicles are a combination of light-duty pickup trucks, vans, SUVs, and sedans; medium-duty vehicles include medium-duty pickup trucks, a few vans, and trucks (primarily used for delivery); and heavy-duty vehicles include trucks (primarily used for delivery).

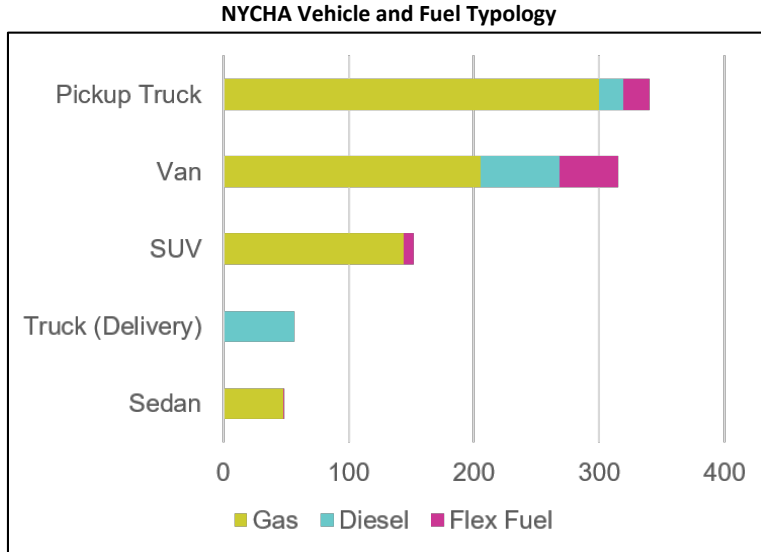
NYCHA Vehicle by Weight Class



Currently, electric vehicle models are only available for sedans and SUVs. Therefore, approximately 200 vehicles (22% of NYCHA’s fleet) are eligible for EV replacement.

Fuel Type

NYCHA vehicles use three main fuel sources: gasoline, diesel, and E85 / flex fuel. The latter refers to a vehicle that uses gasoline, ethanol, or a combination of the two. E85 is a high-level ethanol-gasoline blend containing 51%-83% ethanol.



A majority of the vehicles that currently do not have EV replacement models available use diesel. Diesel, in comparison to gasoline, emits more greenhouse gases: burning 1 gallon of gasoline emits 19.6 pounds of CO₂ whereas burning 1 gallon of diesel emits 22.4 pounds of CO₂. Currently, NYCHA’s fleet does not use biodiesel or renewable diesel. Biodiesel and renewable diesel can reduce emissions upwards of 75% (depending on the mix of diesel and biodiesel or renewable diesel in the fuel).¹

Average Mileage

On average, NYCHA vehicles travel between 10 and 11 miles per day. However, 25% of the vehicles travel less than approximately 4.5 miles per day and 25% travel more than approximately 13.5 miles per day. The relatively low mileage per day opens the door for car sharing opportunities if, for instance, vehicles that are only used in the morning can be used by a different driver in the afternoon. This would eliminate the need to have two separate vehicles.

Average Mileage: May – July 2018 (874 vehicles with Geotab)

	May 2018	June 2018	July 2018
Number of Vehicles in Geotab	874	874	874
Total Miles Travelled	272,024	294,170	225,493
% of Vehicles Used	97.48%	98.86%	94.97%
Average (miles / day)	10.42	11.65	10.87
Q1 (miles / day)	4.54	4.76	4.72
Q3 (miles / day)	13.44	15.41	13.82

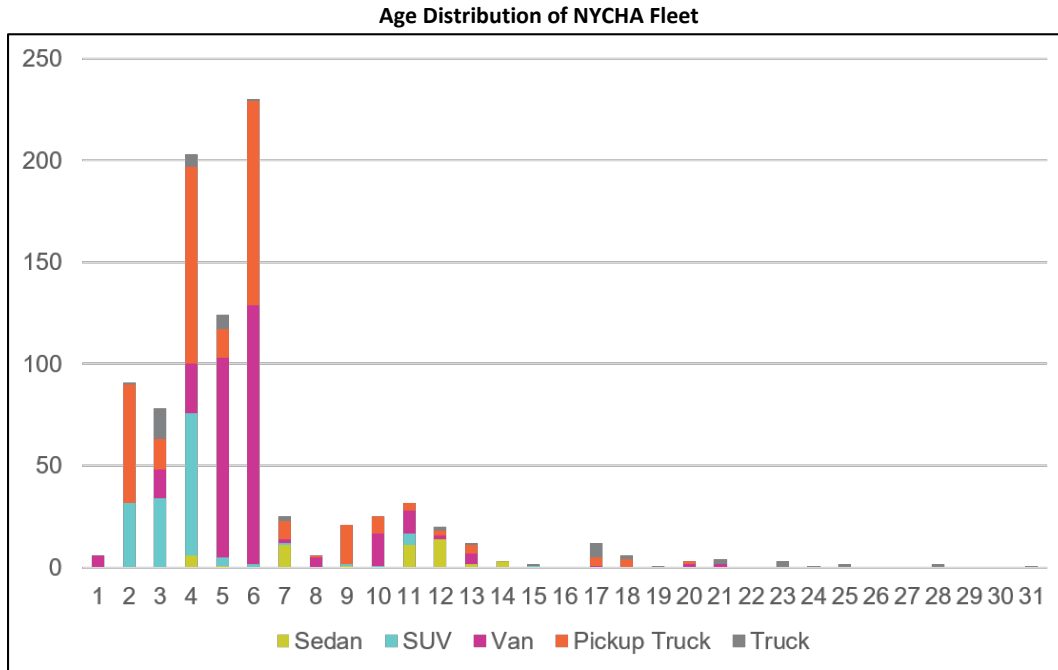
In addition, when looking at sedans and SUVs only – the vehicles that currently have EV substitutes – average mileage per day is 11.4 and 11.82 respectively. The range of a Nissan Leaf, a fully electric vehicle, is 151 miles.² As such, range anxiety should not be an issue or hindrance in adopting electric vehicles. Given the low daily mileage, no productivity will be loss during the day as vehicles can simply charge overnight.

¹ Springboard Biodiesel. “Reducing Your Carbon Footprint With Biodiesel.” Retrieved from <http://www.springboardbiodiesel.com/reducing-your-carbon-footprint-biodiesel>

² “2018 Nissan Leaf.” Retrieved from <https://www.nissanusa.com/vehicles/electric-cars/leaf.html>

Average Age

NYCHA's fleet is, on average, 5.5 years old with a range of 6 months to 30.5 years. Given NYCHA's criteria for replacement – over 10 years old or having used 80% of its initial vehicle price on maintenance³ – the fleet is set to see a high turnover in the upcoming years.



A vehicle's emission control technology (e.g. catalytic converters) deteriorate as the vehicle increases in age and mileage.⁴ As a result, older vehicles will emit more emissions compared to younger, newer models.⁵ If NYCHA were to replace current vehicles with a newer counterpart, it would automatically see GHG emission reductions purely due to lower deterioration levels and newer models (with higher fuel efficiency standards).

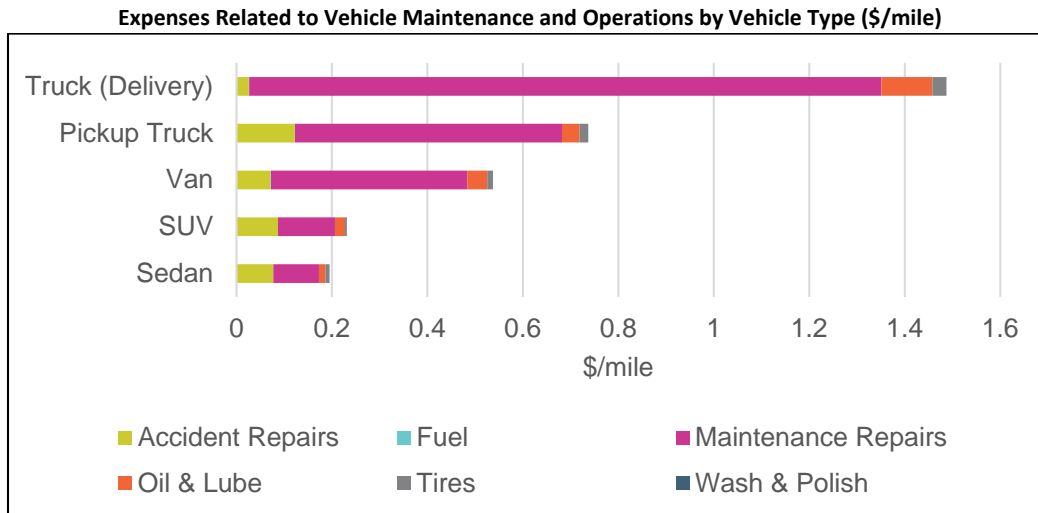
Operating Expenses

Vehicle maintenance repairs makes up the largest share of operating expenses, particularly for heavy-duty and pick-up trucks. In general, vehicles used for hauling (trucks, pick-ups, and vans) are more costly to maintain than passenger vehicles (SUVs and sedans). Heavy duty trucks are particularly costly in comparison to medium- or light-duty pick-up trucks.

³ It should be noted, however, that these criteria are not hard rules. Given budgetary constraints, vehicles are often "stretched out". As such, the latter criterion, using 80% of its initial vehicle price on maintenance, is more used. However most often, vehicle replacement is on a case by case basis.

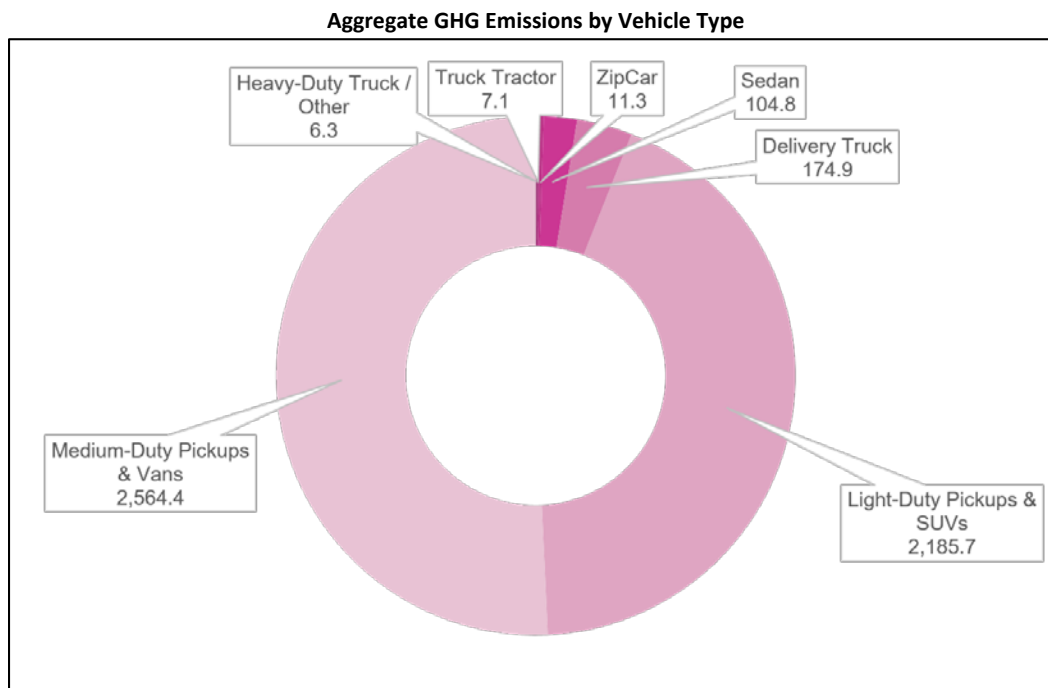
⁴Arkansas Department of Environmental Quality. "Cars and Air Pollution." Retrieved from <https://www.aeq.state.ar.us/air/planning/ozone/cars.aspx>

⁵ This is also due to tighter emission standards (so that newer vehicles have higher mpg requirements than older vehicles).



GHG Emissions and Air Pollution

In 2017, NYCHA’s vehicle operations accounted for approximately 5,055 short tons of CO₂. Most emissions come from light-duty pickups & SUVs and medium-duty pickups & vans. This is not surprising given that these vehicle classifications make up approximately 90% of NYCHA’s fleet. To put this in perspective, NYCHA’s GHG emissions from vehicle operations is equivalent to 1,000 passenger vehicles each driving 12,000 miles.

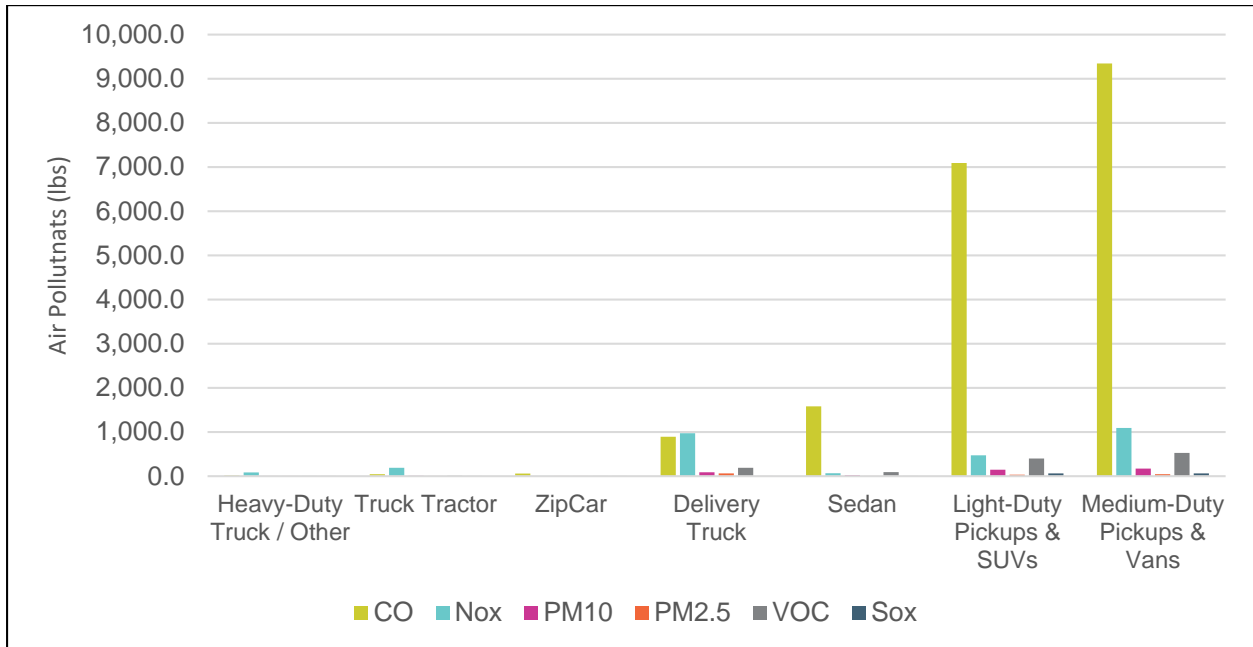


In addition to GHG emissions, NYCHA’s fleet uses 9,706 barrels of petroleum annually. This is equivalent to the amount of petroleum used by just over 440 individuals in the US in one year (for all petroleum uses).⁶

⁶“Petroleum Consumption.” Retrieved from <http://world.bymap.org/OilConsumption.html>

NYCHA will also see reductions in air pollutants as it shifts to a cleaner fleet. Reductions in air pollutants have considerable benefits to health – and can contribute to the creation of safer and healthier communities.

NYCHA’s annual air pollutant footprint by Vehicle Type



Total Air Pollutants by Vehicle Type

Vehicle Type	CO (lbs)	NO _x (lbs)	PM ₁₀ (lbs)	PM _{2.5} (lbs)	VOC (lbs)	SO _x (lbs)
Heavy-Duty Truck / Other	16.5	84.4	2.4	1.2	4.1	0.1
Truck Tractor	45.9	188.5	7.2	5.6	8.2	0.1
ZipCar	60.0	3.5	2.3	0.5	5.7	0.3
Delivery Truck	893.6	971.6	90.2	63.6	190.5	2.4
Sedan	1,581.5	65.3	22.0	5.3	92.3	3.1
Light-Duty Pickups & SUVs	7,093.0	473.0	146.9	34.2	401.2	62.3
Medium-Duty Pickups & Vans	9,346.0	1,093.3	170.7	46.3	526.4	64.5
Total	19,036.5	2,879.7	441.6	156.8	1,228.4	132.8

The sources of these air pollutants come primarily from a vehicle’s tailpipe or from tire and brake wear:

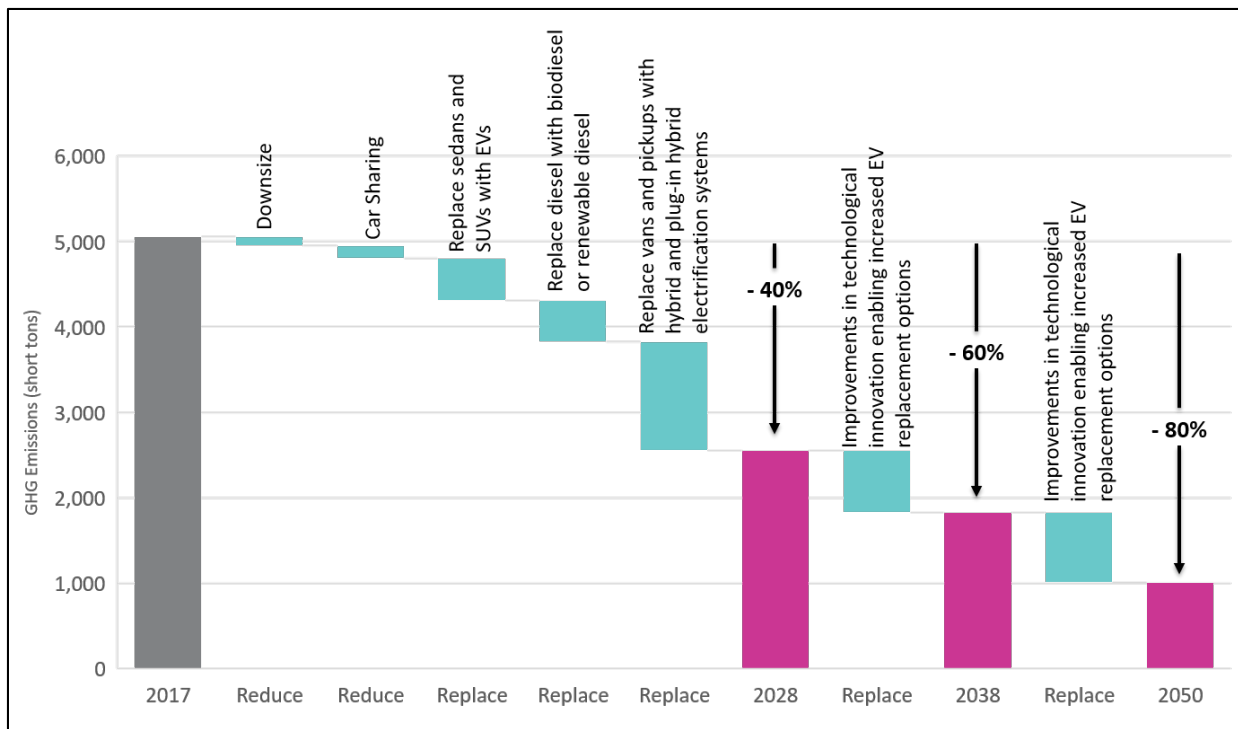
- Carbon monoxide (CO) from tailpipe
- Nitrogen oxides (NO_x) from tailpipe
- Particulate matter with a diameter of 10 micrometers or less (PM₁₀) from tailpipe and tire and brake wear
- Particulate matter with a diameter of 2.5 micrometers or less (PM_{2.5}) from tailpipe and tire and brake wear

- Volatile organic compounds (VOCs) from tailpipe and evaporation
- Sulfur oxides (SO_x) from tailpipe

Part 2: Clean Fleet Plan Impacts

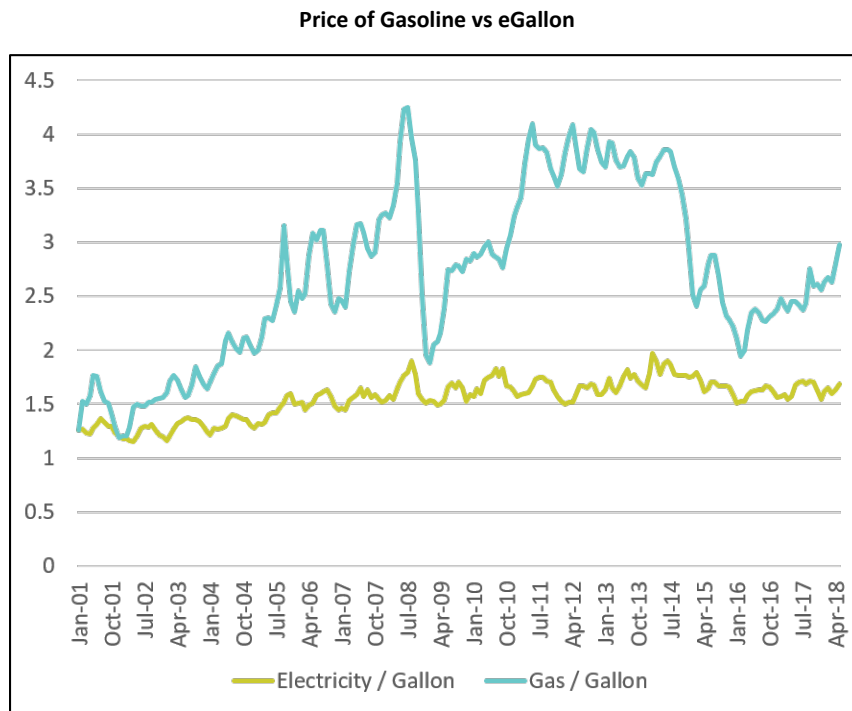
Green House Gas Impacts: Achieving NYCHA’s 10-year goal will be directly impacted by technological innovation. As such, our analysis looks at two different scenarios. The first scenario assumes no technological innovation: pure electric vehicles are only available for sedans (with hybrid options available to SUVs, vans, and pickup trucks; and plug-in hybrid options available to some pickup trucks) and replacement of diesel with B20 or RD20 (as opposed to B100 or RD100). The second scenario assumes technological innovation starting in 2021:⁷ all electric vehicle models are available for both sedans and SUVs, plug-in hybrid electrification systems are available for vans and pickup trucks, and replacement of diesel is with B100 or RD100. The first scenario (no technological innovation) predicts a GHG emission reduction of only 26% by 2028; whereas the second scenario (technological innovation) predicts a GHG emission reduction of 49% by 2028. Given this large range of outcomes, NYCHA should monitor emerging technological improvements in partnership with DCAS and NYC Fleet.

Pathways for Emission Reductions in NYCHA’s Clean Fleet Plan



⁷ As will be described in more depth below, the 2021 technological innovation assumption was based on predicted future technological innovation and emerging EV models in manufacturers’ pipelines.

Cost Benefits: The Department of Energy has developed the “eGallon,”⁸ a measure designed to easily compare the cost of electricity used to fuel an EV and the cost of a traditional gallon of unleaded fuel.⁹ Based on New York prices, a regular gasoline gallon is \$2.93, whereas an eGallon is \$1.64. This represents a 44% reduction in price. In addition to lower prices, the eGallon provides another benefit: compared to the price of gasoline, electricity prices are relatively stable. Figure 2 below showcases the price of a regular gasoline gallon and an eGallon from January 2001 to April 2018.



Gasoline prices are considerably more volatile. Switching to electric vehicles, therefore, can provide a way to hedge against the risks of fluctuating and somewhat unpredictable gasoline prices.

⁸ U.S. Department of Energy. “The ‘eGallon’”. Retrieved from <https://www.energy.gov/sites/prod/files/2016/01/f28/eGallon%20methodology%20%28Updated%20January%202016%29.pdf>

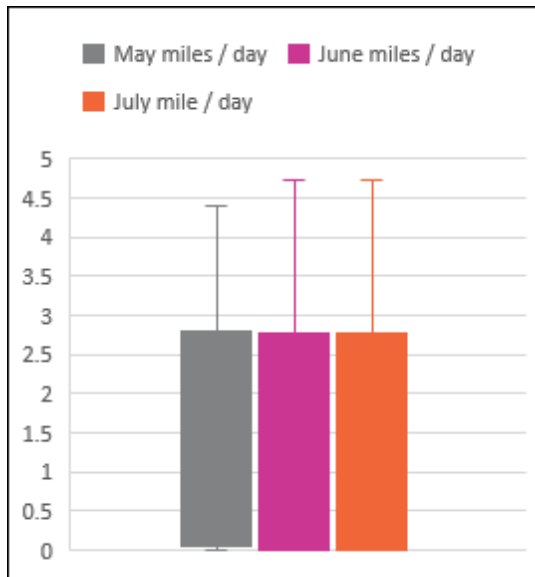
⁹ In mathematical terms, an eGallon (\$/gal) = FE * EC * EP, where FE = the average comparable passenger car adjusted combined fuel economy (miles / gallon); EC = the average electricity consumption (kWh / mi) of the top selling PEVs in the US; and EP = U.S. residential electricity price

Part 3: Analysis and Findings

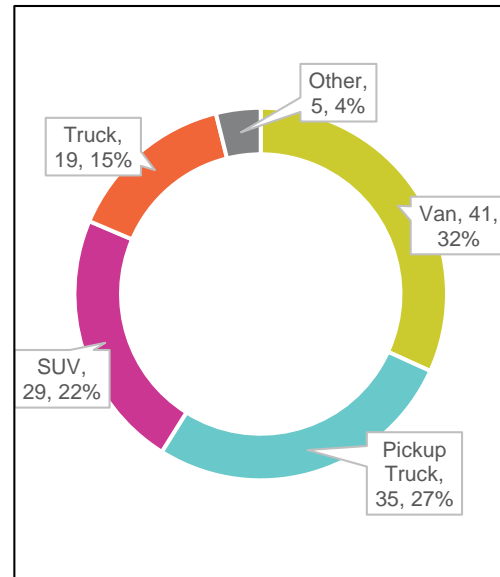
Unused and Underused Vehicles

Using three months of data (May 2018 – July 2018) extracted from Geotab, 129 vehicles were identified to have been in the bottom 25% of average monthly mileage and/or unused for 3 consecutive months.¹⁰ These vehicles traveled less than 5 miles per day, with most traveling less than 3 miles per day. Fifty-eight had not moved for more than 5 days. The breakdown of these 129 vehicles include vans (32%), pickup trucks (27%), and SUVs (22%).

Miles Traveled for 129 Unused and Underused Vehicles



Unused and Underused Vehicles by Type



SUVs and vans (depending on how they are being used) offer potential opportunities for car sharing. Moreover, a far number of these unused and underused vehicles are consolidated within the same department. Figure 16 shows which departments have the 129 unused and underused vehicles.

It should be noted, nonetheless, that this analysis of unused and underused vehicles is only based on 3 months of data. During this timeframe, vehicles were still in the process of being installed with Geotab and drivers were adjusting to utilizing Geotab. As such, we highly recommend that a similar analysis is conducted in 6 to 12 months to get a more accurate list of unused and underused vehicles to target for elimination and / or car sharing opportunities.

Downsizing Opportunities

Occasionally, there is a mismatch between the size or type of vehicle and the required size or type needed to conduct activities. For example:

¹⁰ This also includes vehicles that, according to Geotab, have been disconnected from the Geotab system. Given that the system beeps if a user has not “swiped” into the vehicle, disconnections are most likely a result of the vehicle not being used. A small percentage might be the result of faulty sensors, but this was judged to be unlikely after conversations conducted with Geotab.

- If an individual is using an SUV purely to transport him- or herself, the individual could instead use a smaller vehicle, such as a sedan
- If a van is used to transport individuals, as opposed to store and transport equipment, two SUVs or sedans could be used instead
- If a pickup truck is being used to transport individuals (not equipment), a sedan could be used or a smaller vehicle (e.g. minicar, golf cart, etc.)¹¹

In addition, there are also opportunities to shift from medium-duty to light-duty pickup trucks. Downsizing has significant benefits in terms of financial savings (e.g. fuel and maintenance) and GHG emissions.

Downsizing Savings from downsizing current NYCHA vehicles to smaller and cleaner models

Downsizing	GHG Emission Reductions (short tons)	GHG Emissions Savings	Maintenance and Fuel Savings
SUV (Gasoline) to EV Sedan	2.7	\$128.18	\$844.61
Van (Gasoline) to 2 Hybrid SUVs	2.22	\$118.22	\$887.99
Light-Duty Pickup Truck (Gasoline) to EV Sedan	2.9	\$133.81	\$3,209.17
Medium-Duty Pickup Truck (Diesel) to Light-Duty Pickup Truck (B20)	2.4	\$119.96	\$440.90 (fuel only)

We recommend that NYCHA initiate focus groups with a variety of NYCHA drivers and departments to understand (a) what each vehicle is being used for and (b) if there are opportunities for downsizing. Moreover, these focus groups will help discover why NYCHA employees seek out certain cars (e.g. SUVs) and will help NYCHA develop internal rules or education programs to encourage opting for smaller, more environmentally-friendly and cost saving vehicles.

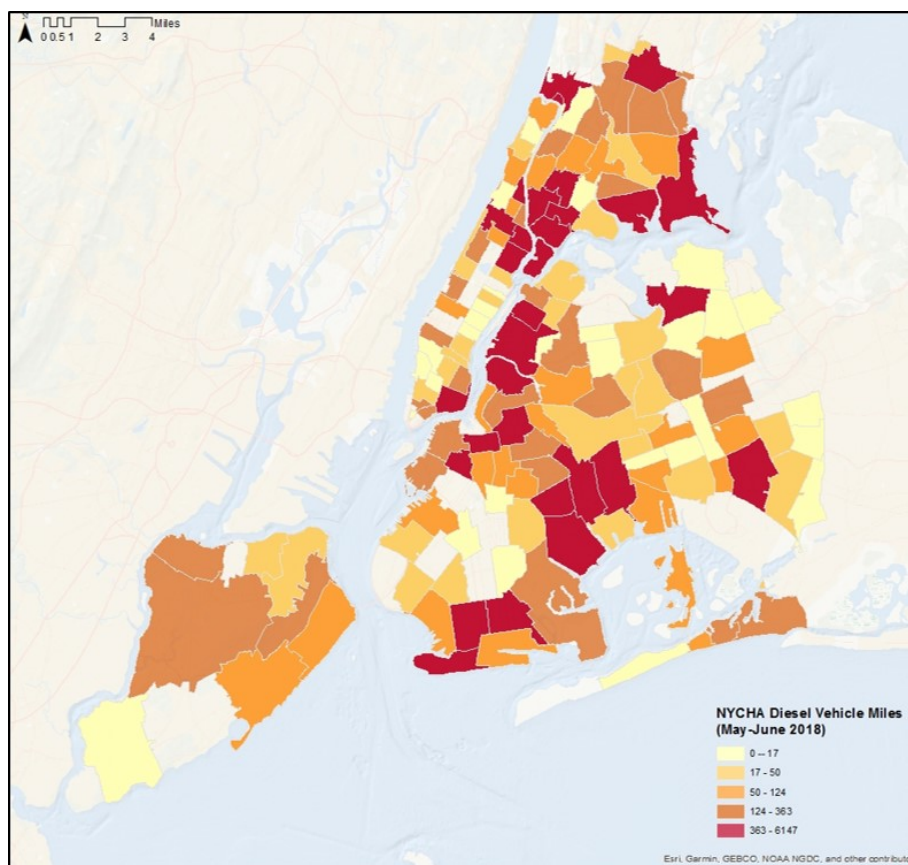
Biodiesel and Renewable Diesel

There are currently limited electric vehicle options for vehicles larger than SUVs. However, there are alternative mechanisms to reduce GHG emissions, with the most prominent being the utilization of biodiesel or renewable diesel in replacement of diesel fuel. Diesel vehicles account for approximately 14% of NYCHA’s annual GHG emissions (700 short tons of CO₂). Vans (63), pickup trucks (17 light-duty;

¹¹ Joseph LaMarca noted how some developments use pickup trucks for “runs” (i.e. transporting paperwork from one development to another). Pickup trucks are not needed for such activity and a sedan could be used instead. This would significantly reduce GHG emissions as well as savings from fuel and maintenance.

23 medium-duty), and trucks (29) use diesel for fuel. The map below highlights where NYCHA's diesel vehicles currently travel.

NYCHA Diesel Vehicle Hot Spots



Currently, DCAS has contracts for both biodiesel and renewable diesel. Biodiesel, which is made from feedstocks (e.g. oils and recycled cooking grease), is a renewable alternative to traditional diesel. Typically, biodiesel is blended with traditional diesel (B5: 5% biodiesel; B20: 20% biodiesel). Less carbon pollution is emitted as the biodiesel blends increase.¹² Local Law 73 of 2013 passed by the City Council requires that on-road diesel fuel-powered vehicles owned or operated by a city agency use an ultra-low sulfur diesel fuel blend of B5 or higher; however, during the summer months, B20 must be used for non-emergency fleets.¹³ Currently, the City has over 400 independent biodiesel fueling sites and used 15.6 million gallons of diesel / biodiesel blends in FY15.¹⁴

Renewable Diesel (RD) is created from plant products and animal fats. The use of RD, in comparison to fossil fuels, reduces GHG emissions more than 60%. Compared to higher blends of biodiesel, RD does

¹² Environmental Defense Fund & Environmental Entrepreneurs (August 2013). "Biodiesel in California: Companies Fueling Positive Change." Retrieved from <https://www.edf.org/sites/default/files/sites/default/files/content/Biodiesel%20Value%20Chain%20-%20August%202013.pdf>

¹³ National Association of State Energy Officials (June 2016). "Biodiesel Fueled Vehicles and Emergency Response." Retrieved from http://www.nyc.gov/html/dcas/downloads/pdf/fleet/irev_biodiesel_case_study.pdf

¹⁴ Ledesma-Garrido, Ramona (September 2015). "NYC Fleet: New York City's B20 Compatibility Program for its Fleet Diesel Fuel Storage Facilities." *NYC Citywide Administrative Services: Fleet*. Presented at the 25th National Tanks Conference & Exposition and retrieved from http://home.nyc.gov/html/dcas/downloads/pdf/fleet/ledesma_garrido_compatibility_2015_09_11.pdf

not face the same cold weather and materials compatibility issues.¹⁵ In May 2018, DCAS signed a partnership with Renewable Energy Group (REG) to use renewable diesel. REG will produce it domestically and Sprague Energy¹⁶ will distribute it. In total, the demonstration contract will supply 900,000 gallons of renewable diesel fuel for the City fleet (specifically Sanitation, Parks, DOT, and DEP).¹⁷ The contract ends on September 30th, 2018.¹⁸

Replacing diesel with biodiesel and renewable diesel is an easy switch, especially given the availability of fueling sites and the already established contracts with providers via DCAS. No changes to the vehicle are required to use biodiesel or renewable diesel as opposed to diesel. Moreover, the Fleet Federation intends to be off diesel within a year – utilizing biodiesel or renewable diesel in its replacement. Therefore, NYCHA should get access to biodiesel and renewable diesel relatively easily.

In addition, we recommend that NYCHA educate its employees on why NYCHA is switching away from diesel and moreover ensure that employees are using biodiesel or renewable diesel and are aware of fueling station locations.

Using biodiesel or renewable diesel for all diesel vehicles would reduce GHG emissions between 2% and 9.5%, with a savings in GHG emission externalities of between \$4,300 and \$21,660 per year. Transitioning 63 vans to biodiesel or renewable diesel would reduce total GHG emissions between 1% and 5%.¹⁹

GHG Emission Reductions for Diesel Vans

	Annual GHG Emission Reductions (short tons) ²⁰	Annual GHG Emission Externality Costs (\$)
Biodiesel 20	52.65 (1% reduction)	\$2,295.04
Biodiesel 100	263.23 (5% reduction)	\$11,475.21
Renewable Diesel 20	52.47 (1% reduction)	\$2,287.38
Renewable Diesel 100	262.35 (5% reduction)	\$11,436.91

¹⁵ Kerman, Keith (May 2018). "DCAS Announces Renewable Diesel Program." *NYC Fleet Newsletter: Issue 220*. Retrieved from <http://www.nyc.gov/html/dcas/downloads/pdf/fleet/ NYC Fleet Newsletter 220 May 2 2018 Renewable Diesel Announcement.pdf>

¹⁶ In NYC, Sprague Energy provides natural gas, electricity, delivered fuel, wholesale fuel, and materials handling.

¹⁷ Kerman, Keith (May 2018). "DCAS Announces Renewable Diesel Program." Retrieved from <http://www.nyc.gov/html/dcas/downloads/pdf/fleet/ NYC Fleet Newsletter 220 May 2 2018 Renewable Diesel Announcement.pdf>

¹⁸ Conversation with Jonathan Ells (6/20/18)

¹⁹ To calculate savings, the customized AFLEET tool was used. Since no vehicles were being replaced, only fuel was being replaced, to compare the "current fleet" with the "replacement fleet", the current fleet's MPG was also used for the replacement fleet. In addition, age was adjusted such that the replacement fleet was the same age as the current fleet (as opposed to being "brand new", i.e. age 0).

²⁰ The majority of GHG emissions savings from switching from diesel to biodiesel or renewable diesel are not from vehicle operation, but rather from the well-to-wheels cycle which includes production. The table below looks at the whole operating cycle. It should be noted that the baseline 2017 GHG emissions only looks at vehicle operation.

Moving all diesel pickup trucks (17 light-duty; 23 medium-duty) and trucks (29) to biodiesel or renewable diesel would reduce total GHG emissions between 1% and 4.5%.

GHG Emission Reductions for Pickup Trucks and Trucks

Fuel	Vehicle	Annual GHG Emission Reductions (short tons)	Annual GHG Emission Externality Costs (\$)
Biodiesel 20 (BD20)	Light-Duty Pickup Trucks (17) Age: 5	9.24	\$384.32
	Medium-Duty Pickup Trucks (23) Age: 5	11.49	\$477.54
	Trucks (29) Age: 10	25.25	\$1,182.00
	Total	45.98 (<1%)	\$2,043.86
Biodiesel 100 (BD100)	Light-Duty Pickup Trucks (17)	46.22	\$1,921.59
	Medium-Duty Pickup Trucks (23)	57.43	\$2,387.69
	Trucks (29)	126.26	\$5,909.99
	Total	229.91 (4.5%)	\$10,219.27
Renewable Diesel 20 (RD20)	Light-Duty Pickup Trucks (17)	9.21	\$383.04
	Medium-Duty Pickup Trucks (23)	11.45	\$475.94
	Trucks (29)	25.17	\$1,178.05
	Total	45.83 (<1%)	\$2,037.03
	Light-Duty Pickup Trucks (17)	46.07	\$1,915.18

Renewable Diesel 100 (RD100)	Medium-Duty Pickup Trucks (23)	57.24	\$2,379.72
	Trucks (29)	125.84	\$5,890.26
	Total	229.15 (4.5%)	\$10,185.16

In addition to 915 on-road vehicles, NYCHA also has over 2,000 pieces of horticultural equipment that use diesel fuel. Last year alone, over 55,000 gallons of diesel were used – this equates to 623 short tons of CO₂.²¹ A simple switch from diesel or biodiesel could result in a reduction of 40 short tons of CO₂ (6.4% reduction).

On a similar front, 470 light towers are placed in 55 of NYCHA’s developments, as part of the Mayor’s Action Program and Light Tower Study. NYCHA vehicles currently fill these light towers up with diesel fuel. NYCHA should explore whether (a) the light towers can utilize biodiesel or renewable diesel or (b) if the light towers can be switched to solar light towers.²²

Given the Fleet Federation’s desire to eliminate diesel from all vehicles and use biodiesel or renewable diesel, we recommend that NYCHA push DCAS to utilize B100 and RD100 more regularly, as higher grades exhibit greater GHG emission reductions.²³

Electrification of Sedans and SUVs

NYCHA has two main criteria for vehicle replacement:

1. **Age:** 10+ or older
2. **Cost:** more than 80% of its initial vehicle price has been used on maintenance related charges

It should be noted, however, that Criteria 2 is more heavily used than Criteria 1. Given budgetary constraints, vehicles are often “stretched out”. As such, the latter criterion, using 80% of its initial vehicle price on maintenance, is more used. However most often, vehicle replacement is on a case by case basis.

GHG savings path analysis uses a 10-year model of vehicle turnover for sedans and SUVs based on the current vehicle’s age and the inferred future maintenance cost (based on average yearly maintenance expenses). Two models were created to showcase GHG emission reductions and subsequent financial savings. The first assumes no technological improvement: all sedans are replaced with EV counterparts and all SUVs are replaced with hybrid counterparts. The second assumes technology improvement

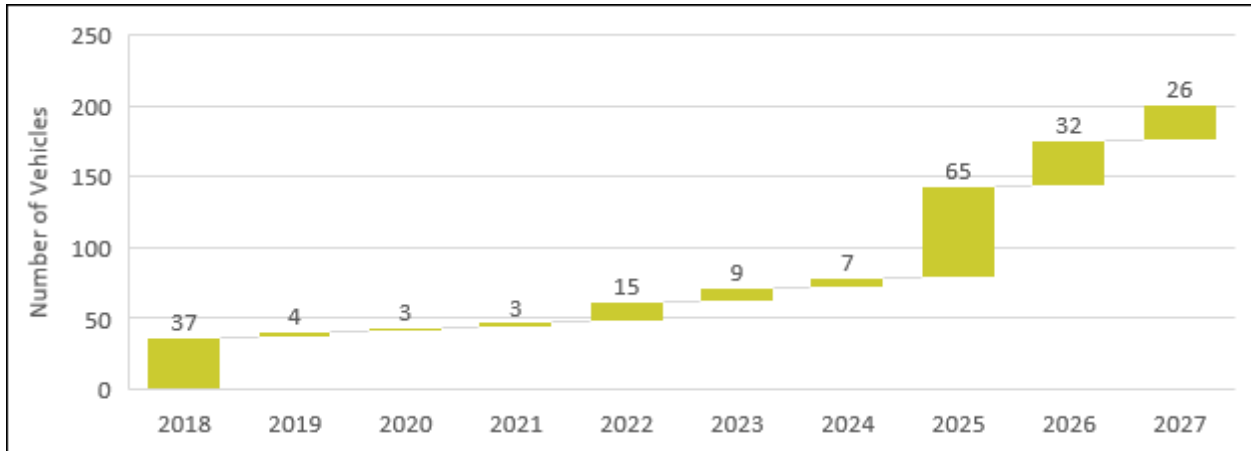
²¹Emissions factors taken from: EPA (April 2014). “Emission Factors for Greenhouse Gas Inventories.” Retrieved from https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

²² DCAS has a contract with Progress Solar Solutions for the supply of solar-electric, zero emission light towers for mobile fleet operations. NYCHA should try to join this program. Source: Gold, Jacqueline (December 2017). “DCAS Finalizes Contract for Solar Portable Light Towers; Zero Emission, Zero Noise Units Will Replace Diesel Generators.” Retrieved from http://www.nyc.gov/html/dcas/downloads/pdf/fleet/press_release_nyc_fleet_solar_light_towers.pdf

²³ Of course, this push should only be encouraged if B100 and RD100 do not negatively impact vehicle operation.

starting in 2021: all sedans are replaced with EV counterparts and all SUVs are replaced with hybrid counterparts until 2021 in which SUVs are replaced with EV counterparts.

Modeled 10-year Replacement Timeline for Sedans and SUVs



GHG and Financial Savings for Replacements: Sedans and SUVs

	Scenario 1: No Technological Improvement	Scenario 2: Technological Improvement
Total GHG Emission Reduction (short tons) by 2027	276	491
Percentage Reduction in GHG Emissions by 2027	5.5%	10%
Total Savings by 2027	\$544,400 <i>GHG Emission Externality Savings: \$69,887</i> <i>Maintenance Cost Savings: \$371,581</i> <i>Fuel Cost Savings: \$156,932</i>	\$555,063 <i>GHG Emission Externality Savings: \$92,482</i> <i>Maintenance Cost Savings: \$340,402</i> <i>Fuel Cost Savings: \$122,179</i>
Average Annual Savings per Year	\$60,489	\$61,674

EV Charging Technology

Currently, there are three main types of EV charging infrastructure: Level 1, Level 2, and Level 3. Increase in level (from Level 1 to Level 3) results in an increase in price but a decrease in the total recharge time.

EV Charging Infrastructure Categories

	Level 1	Level 2	Level 3 (DC)
Voltage	120 V	240 V	DC Fast Charger
kW	1.4 kW	3.6 – 17 kW	25 – 300 kW
Recharge Time	12 – 24 hours	3 – 7 hours	30 minutes
Charger Cost	Comes with EV	\$1,500 - \$3,000	\$20,000 - \$30,000
Installation Cost	None	\$2,000 - \$10,000	\$15,000 - \$40,000
Costs		Slower charge	Higher infrastructure cost; grid impact
Benefits		Grid management opportunities; lower infrastructure cost	Faster charge when you need it

Given NYCHA requirements (most vehicles travel between 10 – 11 miles per day and therefore would not require Level 3 charging capabilities) and financial constraints, NYCHA will most likely be looking to install Level 2 chargers.

GIS Analysis: Charging Station Hot spots

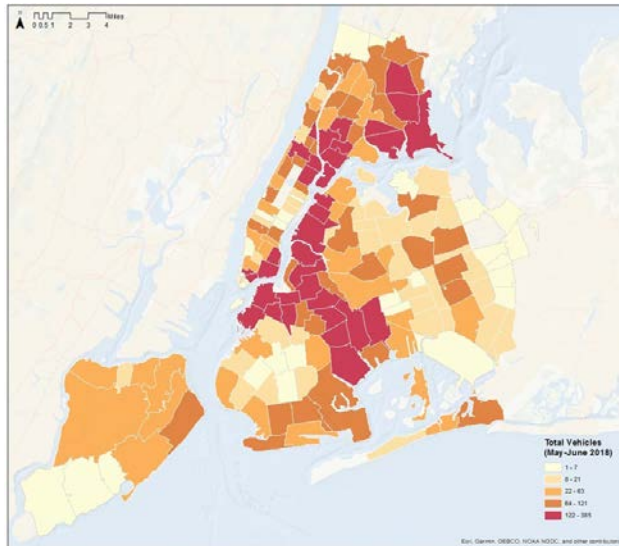
In order to determine where EV charging infrastructure should be installed, it is necessary to address two key questions:

1. Where do NYCHA’s 915 on-road vehicles travel?
2. What are the ideal locations for charging stations based on existing routes and parking availability?

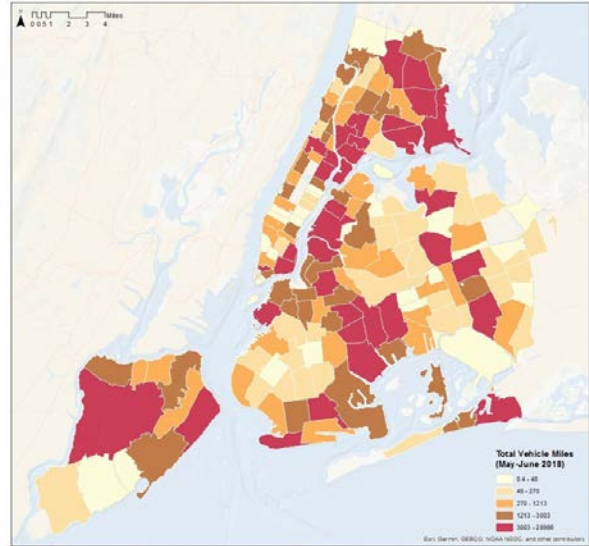
To answer these questions, one month’s worth of Geotab data was utilized, in conjunction with vehicle information obtained from ARI. This data was combined with a number of shapefiles (NYC ZIP codes, NYCHA development sites, NYCHA buildings, and NYC parking lots).

Given the available data, analysis was performed at the ZIP code level. In particular, ZIP code hot spots were identified that (a) exhibit a high number of vehicles coming in and out and (b) exhibit a high amount of mileage / travel.

Hot Spots by Number of Vehicles (per month)

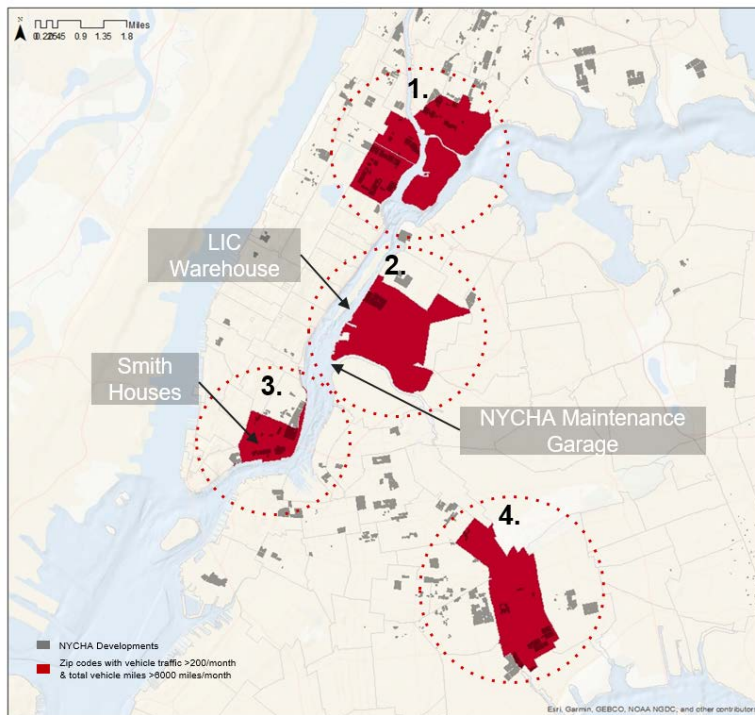


Hot Spots by Vehicle Mileage (per month)



To identify key hotspots, analysis was conducted overlaying these two variables. As a result, four areas were identified as hot spots for EV charging infrastructure.

Combined Vehicle Hot Spots

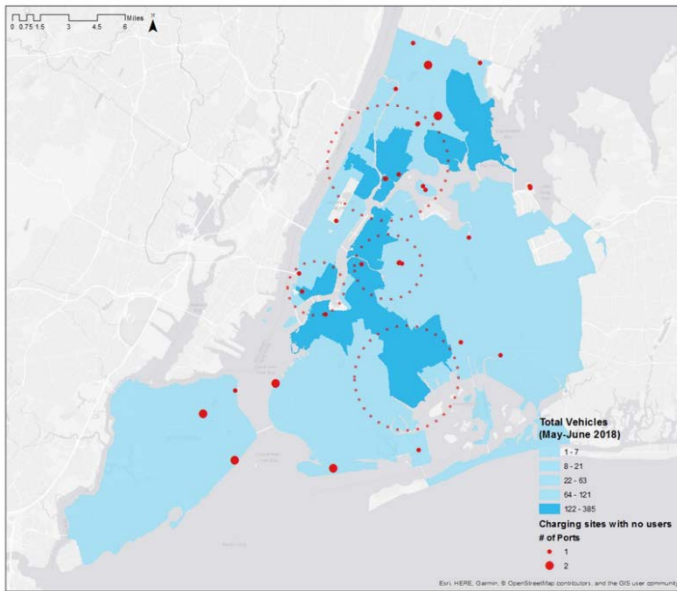


These four locations include:

- 1. Upper East Side / Bronx**
 - a. Total Monthly Miles: 29,170
 - b. Total Vehicles (average): 271
- 2. Long Island City**
 - a. Total Monthly Miles: 28,986
 - b. Total Vehicles (average): 385
- 3. Lower East Side**
 - a. Total Monthly Miles: 9,328
 - b. Total Vehicles (average): 234
- 4. Eastern Brooklyn**
 - a. Total Monthly Miles: 11,869
 - b. Total Vehicles (average): 256

Given the locations of Smith Houses, the Long Island City Warehouse, and NYCHA Maintenance Garage, these three locations present prime opportunities for EV charging infrastructure. In addition, as part of the Fleet Federation, NYCHA has access to DCAS's 500-installed EV charging stations. Based on analysis of usage rates of EV charging stations, a number of underused DCAS charging stations exist in NYCHA's hot spots (high traffic areas). These charging stations should be more deeply explored to see if they are continually underused.

Underused DCAS Charging Stations and NYCHA Hot Spots



Methodology

Three sources were used to obtain baseline information for NYCHA's fleet:

- **Geotab:** Nearly all NYCHA vehicles (874 out of 915) have been equipped with a sensor (via AT&T) that connects to Geotab, an online platform that allows users to track vehicle movements and other information (including routes, miles travelled, idling time, fuel usage, etc.). Most of the analysis to follow is based on data extracted from Geotab covering a one-month interval (May 24th – June 25th, 2018). This data was used to extrapolate NYCHA's annual vehicle usage and GHG emissions.
- **ARI:** ARI manages NYCHA's fleet operations and provides maintenance services. It provides general vehicle information as well as service / maintenance history.
- **AFLEET Tool:** Created by Argonne National Laboratory, the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool allows users to estimate petroleum use, GHG emissions, air pollutant emissions, and cost of ownership for light- and heavy-duty vehicles. AFLEET utilizes several data sources, including Argonne's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) fuel-cycle model; EPA's Motor Vehicle Emission Simulator (MOVES) and certification data; and other sources to identify default cost data. This tool was customized to NYCHA's current fleet composition. Customization enabled a more accurate estimate of GHG and financial savings from transitioning NYCHA's current vehicle fleet²⁴ to a replacement fleet (utilizing either hybrids, plug-in hybrids, or all electric vehicles or alternative sources of fuel, i.e. biodiesel or renewable diesel).

GHG Emission Methodology

To calculate baseline GHG emissions, data from both ARI and Geotab were used.

Before GHG emissions were calculated using the AFLEET tool (see below for more information), the data was cleaned:

- **Fuel Type:** ARI did not provide fuel types for all vehicles. If fuel type was missing, the fuel type of a similar vehicle was used.
- **Travel:** Travel information was taken from Geotab. However, if there no data in Geotab was provided either because (a) the vehicle had not been equipped with the Geotab sensor or (b) the vehicle was stopped / parked during the timeframe in which the Geotab data was extracted, then average miles travelled per month were calculated using ARI data (e.g. current odometer reading divided by vehicle age in months). It should be noted that this action was taken purely to obtain average yearly GHG emissions from NYCHA's fleet. The vehicles that have been stopped / parked for a significant amount of time will be analyzed to suggest opportunities for elimination or car-sharing.
- **Vehicles with no data:** For some vehicles, no data was provided from ARI or Geotab. These vehicles were excluded from analysis (e.g. AZ8290 had information about fuel type but no data on odometer / miles traveled in ARI or GeoTab; AY7667 was on Geotab but had been stopped

²⁴ Comparisons of NYCHA's current fleet to the replacement fleet utilized the current fleet's average annual mileage, miles per gallon, and maintenance costs for each vehicle category. Such a comparison allowed for a more accurate prediction of GHG and financial savings for NYCHA's vehicle composition.

for a while and no information was provided via ARI regarding odometer reading; AB8065 was not in GeoTab and was missing in ARI). This is a small portion of vehicles (less than 10).

- **MPG:** This was obtained from Geotab. There were several inaccurate MPGs (e.g. ones below 5 or greater than 60). To compensate, two actions were taken. First, MPGs were downloaded from Geotab for a period of two months. These were compared with the one-month data, with the smaller of the two being selected.²⁵ After this was completed, MPGs that were missing or did not make sense (i.e. were less than 5 or greater than 60), the typical MPG of 21.4 for gas and 6.3 for diesel was used.
 - This decision was based on MPG decisions made in the past. In the Clean Fleet Report, the average fuel economy of 21.4 for gas and 6.3 for diesel was used (based on 2011 Highway Statistics, Table VM-1, 2013). In addition, in DCAS’s “Re: Local Law 75: Report on Use Based Fuel Economy for City Fleet”, MPGs that were less than 5 or greater than 60 were eliminated from their analysis.²⁶
- **Gallons:** Based on the changes made to MPG, gallons were obtained either via Geotab or by through the calculation of distance divided by MPG (if Geotab data was unreliable or unavailable).

A number of departments within NYCHA also use Zipcar. To approximate annual usage, data was extracted for one month from Zipcar. Since no information was available on type of car used, we assumed a sedan vehicle type and a 2017 model.²⁷

The one-month data from Geotab was used to approximate yearly usage by NYCHA vehicles.

To calculate annual GHG emissions from vehicle operations Argonne’s AFLEET tool was used. The tool requires the following inputs:

1. Vehicle Type
2. Model Year
3. Annual Vehicle Mileage
4. Fuel Use (gallons) and Fuel Type

AFLEET’s vehicle type was aligned with NYCHA’s vehicle classification as follows:

AFLEET Vehicle Type	NYCHA Vehicle Classification
Passenger Car	Sedan
Passenger Truck	SUV; Light-Duty Pickup Truck

²⁵ The smaller of two was selected as to get the maximum GHG emissions.

²⁶ Kerman, Keith (March 2018). “Local Law 75: Report on Use Based Fuel Economy for City Fleet.” Retrieved from http://www.nyc.gov/html/dcas/downloads/pdf/fleet/Local_law_75_report_on_use_based_fuel_economy_FY17.pdf

²⁷ Zipcar states that cars are replaced either every year or every two years depending on the make and model. We therefore assumed that cars being utilized by Zipcar are relatively new. Source: Zipcar (2008). “Frequently Asked Questions.” Retrieved from <http://org.elon.edu/sustainability/documents/Zipcar%20FAQs.pdf>

Light Commercial Truck	Medium-Duty Pickup Truck; Shuttle / Paratransit Van; Utility Cargo Van
Single Unit Long-Haul Truck	Delivery Straight Truck
Combination Short-Haul Truck	Truck Tractor
Combination Long-Haul Truck	Long Haul Freight Truck; Other
Passenger Car (Zipcar)	Sedan (Zipcar)

For each AFLEET vehicle type, model year, annual vehicle mileage, and fuel usage (gallons) were found by averaging the collective vehicle type.

<http://on.nyc.gov/nextgeneration>