December 2015

NYC Clean Fleet

New York City will lead by example in pursuing 80×50 transportation emissions reductions by improving the sustainability of its municipal vehicle fleet

NYC Clean Fleet

Overview

Climate change is an existential threat to New Yorkers and the world, and New York City is leading the way in both reducing our contributions to climate change and addressing its impacts. In *One New York: The Plan for a Strong and Just City* (OneNYC), the City of New York affirmed its commitment to reduce its overall greenhouse gas (GHG) emissions 80 percent below a 2005 baseline by 2050 (80×50).[1] To advance this goal, OneNYC implementation efforts are pursuing GHG emissions reductions opportunities in four major sectors: buildings, energy supply, transportation, and solid waste.

To meet New York City's 80×50 goal, annual transportation sector GHG emissions will likely need to drop by 7 million metric tons (12 percent of the city's total 2005 emissions) in the coming decades. For context, in 2013 the transportation sector – which includes private vehicles, freight, and mass transit (subway, commuter rail, and bus) – was responsible for 11.4 million metric tons of GHG emissions, or 24 percent of the city's total emissions.[2] In addition to GHGs, on-road vehicles emit particulates and other air pollutants such as nitrogen and sulfur oxides (NO_x and SO_x). These air pollutants are detrimental to public health (increasing premature mortality and the number and severity of asthma and cardiovascular disease), as well as the economy (as poor health causes New Yorkers to miss work and school).

To meet its ambitious GHG emissions reduction goals for the transportation sector, New York City will need to ease reliance on fossil-fueled vehicles. This can be achieved by adopting a portfolio of strategies, including expanded access to transportation alternatives – mass transit, biking, and walking – as well as cleaner fueling technologies (e.g., biofuels, hydrogen, natural gas and electricity) to power remaining vehicle travel.

The City of New York seeks to lead by example in the transition to a less carbon-intensive transportation sector. As the Mayor's Office works to advance the policy and technology innovations outlined in OneNYC, the City government is launching a multi-agency fleet sustainability plan to aggressively cut emissions from its own vehicles while ensuring agencies can meet their vital operational needs. With more than 29,000 fleet units, decisions regarding investment and procurement for the New York City government fleet can catalyze the uptake of zero-emissions, clean, and renewable solutions for vehicles and fuels of privately owned fleets and those of other municipalities.

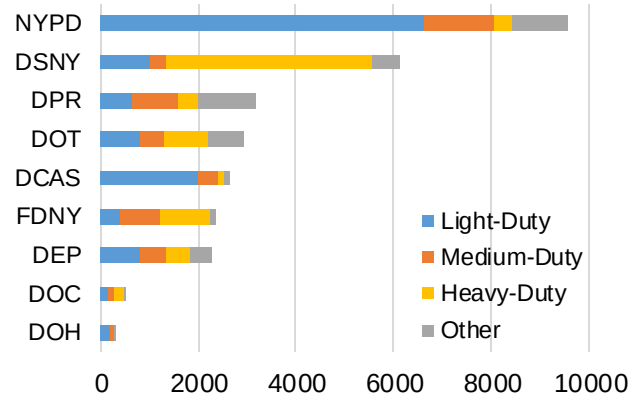
As a result of **NYC Clean Fleet**, New York City will:

- **Add 2,000 electric vehicles (EVs) to its municipal vehicle fleet by 2025, which would give New York City the largest EV fleet of any U.S. city**
- **Achieve a 50 percent reduction in greenhouse gas emissions from fleet operations below 2005 levels by 2025 and an 80 percent reduction by 2035[3] – equivalent to decommissioning a 65 MW coal power plant in NYC or planting 6 million trees.[4]**

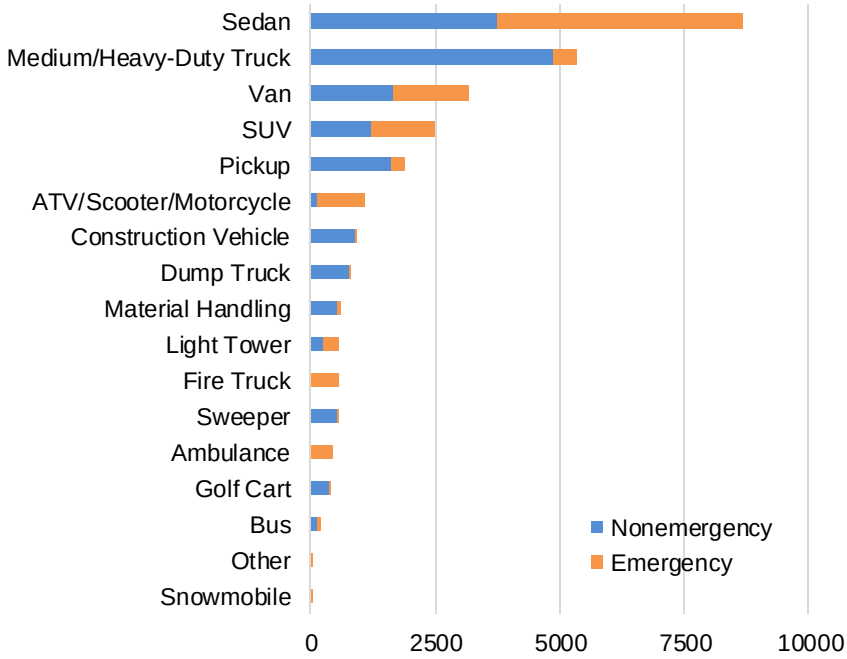
New York City's Vehicle Fleet

New York City government operates a fleet consisting of 27,152 fuel-burning vehicles. These assets span more than 100 fleet categories and serve a variety of agency operational needs. Although most fleet vehicles run primarily on traditional internal combustion engines (ICEs), more than 60 percent of fleet assets run at least partially on alternative fuels; nearly 10,000 fleet vehicles run on biodiesel blends (B5 or B20), more than 5,000 vehicles are hybrids fueled by gasoline, diesel, or solar power, over 800 run on electric (including 323 on-road EVs), and another 250 run on either compressed natural gas (CNG) or propane.

BREAKDOWN OF CITY AGENCY FLEETS BY WEIGHT CLASSIFICATION (SOURCE: DCAS)



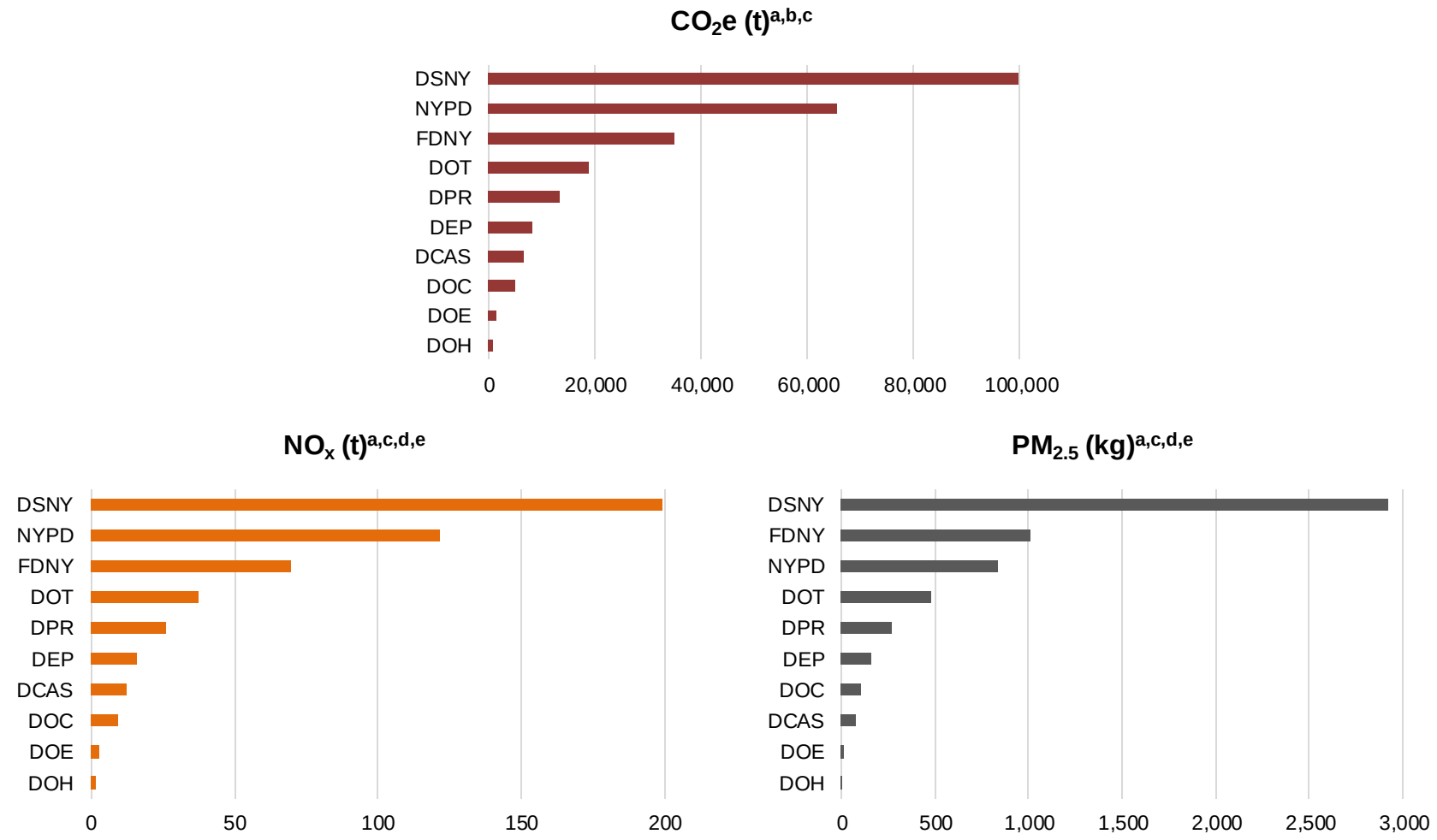
LARGEST CATEGORIES IN NEW YORK CITY FLEET (SOURCE: DCAS)



In fiscal year 2015, City vehicles burned 29.2 million gallons of carbon-based fuel, of which 60 percent was diesel (93 percent of which was blended with biodiesel) and 40 percent was gasoline. The emissions from this magnitude of combustion are significant – in 2013, GHG emissions from the City government vehicle fleet accounted for almost 4 percent of New York City's total on-road transportation-related GHG emissions.[5] In 2015, the City on-road fleet generated more than 255,000 metric tons of GHGs (CO_2e), nearly 500 metric tons of nitrogen oxides, and around 6 metric tons of fine particulates.[6,7] These emissions are comparable to those of an 80 MW coal plant located right in the heart of New York City.

City agencies are already making strides, as fleet emissions in 2015 were 11 percent below 2005 levels. A portion of this progress has come from streamlining the size and utilization of the City fleet; the City recently downsized its fleet by 500 vehicles, and has enrolled 600 agency vehicles in Zipcar's FastFleet car-sharing network to reduce underutilized agency fleet capacity. On a fleet-wide level, the Department of Citywide Administrative Services (DCAS) is on track to install fuel management equipment in all fleet units by the middle of 2016, which will allow fleet managers to monitor fuel consumption, fuel economy, and driving patterns (e.g., idling). City agencies are also poised to replace or retrofit 90 percent of diesel on-road vehicles by 2017 to meet or exceed the U.S. Environmental Protection Agency's 2007 heavy-duty engine and vehicle emissions standards.

VEHICLE AIR EMISSIONS BY CITY AGENCY IN FISCAL YEAR 2015



[a] Fuel consumption data (gasoline and diesel by agency) from DCAS
[b] Global warming potential from Appendix J of 2013 New York City GHG Inventory (City of New York, 2014)
[c] DOE figures do not include school buses operated under contract
[d] Uses average fuel economy (21.4 mpg gasoline, 6.3 mpg diesel) from FHWA's 2011 Highway Statistics, Table VM-1 (2013)
[e] Uses average in-use emission rates of NO_x and $PM_{2.5}$ for gasoline from EPA (2008a) and for diesel from EPA (2008b)

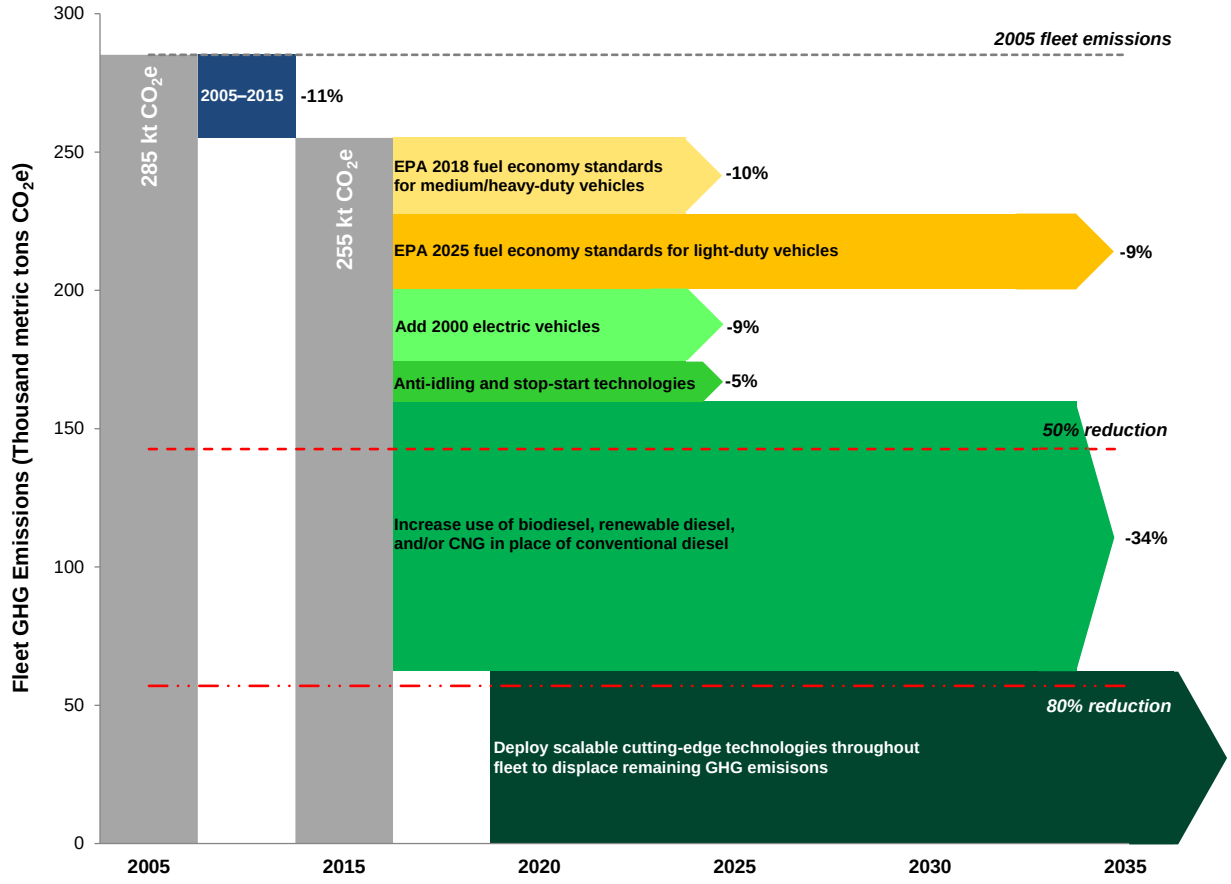
City agencies are also testing technologies to reduce emissions from specialized vehicles without compromising performance. For instance, the Department of Transportation (DOT) has electrified all older diesel-fired screeds (a component of roadway construction trucks). Agencies have also piloted anti-idling and stop-start technologies that reduce engine activity when collection trucks are at rest; Fire Department (FDNY) ambulances have tested auxiliary power unit (APU) battery systems that reduce or eliminate engine idling and the Department of Sanitation (DSNY) now requires that all new collection trucks be equipped to disengage the transmission when stopped – eliminating all tailpipe emissions during these periods.

While federal fuel economy standards[8] will contribute toward reductions in the City government fleet's emissions as more efficient vehicles are phased in over the next twenty years, deeper emissions reductions will require a fundamental rethinking of how the City's fleet is powered. In particular, fleet vehicles will need to shift from traditional fossil-fueled ICEs to new technologies that eliminate or greatly reduce emissions.

NYC Clean Fleet Initiatives

City agencies can operate the cleanest vehicle fleet of any large city in the nation while continuing to deliver high-quality service for New Yorkers. Agencies will begin work on a series of initiatives that capture emissions reduction opportunities in all fleet classes ranging from near-term campaigns to longer-term efforts.

PATHWAYS TOWARD GHG EMISSIONS REDUCTIONS FOR NYC'S VEHICLE FLEET



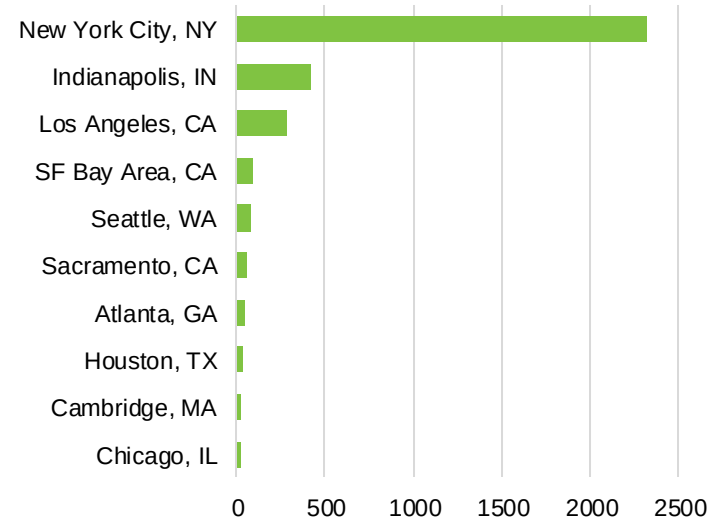
THE LARGEST ELECTRIC VEHICLE FLEET OF ANY U.S. CITY

City agencies currently operate over 11,000 light-duty vehicles (sedans and SUVs). Emergency response agencies (NYPD and FDNY), which account for roughly half of these light-duty vehicles, have more exacting performance requirements than most current EV technologies offer. Even among the non-emergency light-duty fleet, vehicle needs may be incompatible with EVs for other reasons. For instance, some vehicles are used in consecutive shifts and would not allow sufficient time between shifts to recharge an EV battery. Similarly, some vehicles are needed to travel large distances that current EV range may not support, while others that are taken home by commuters may not yet be suitable for an EV transition.

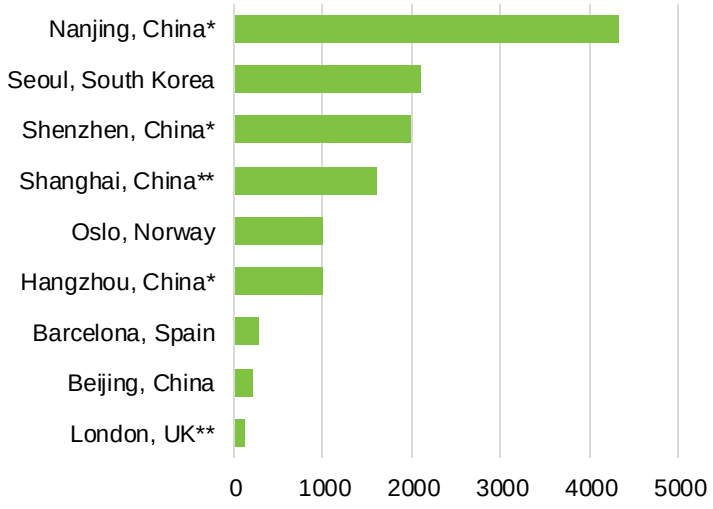
Even with these vehicles removed from consideration, there are more than 2,000 light-duty vehicle uses that can be met by current EV technology (either battery electric (BEV) or plug-in hybrid electric (PHEV)). Accordingly, **City agencies will immediately begin phasing in EVs to satisfy light-duty vehicle needs where operationally and economically feasible, on a path toward introducing an additional 2,000 EVs into the City's fleet by 2025**. With 323 on-road EVs already in the City fleet and 2,000 more to come, **New York City will have the largest government EV fleet in the nation outside that of the federal government as a whole, and among the largest in the world**.

To achieve this target in the next ten years, the City will take steps to reduce barriers to EV penetration. The City will first establish an EV taskforce made up of agency facility and fleet representatives in conjunction with DCAS and the Office of Management and Budget. The EV taskforce will begin to chart EV upgrade phase-in plans for each agency, based on current replacement cycles and operational requirements. By 2025, City agencies will have either added 2,000 new EVs or planned to replace that number of conventional vehicles with EVs where replacement cycles prevent their being added before that time. DCAS will update and modify existing contracts for EVs with various manufacturers and for charging infrastructure and networking.

MUNICIPAL EV TARGETS IN LARGE U.S. CITIES[9]



MUNICIPAL EV FLEETS IN LARGE GLOBAL CITIES[10]



* Includes taxis and/or buses
** Figure reflects "energy-efficient" or "ultra low emissions" vehicles

Additional barriers exist in the form of spatial constraints in existing buildings and parking lots – EVs require charging infrastructure, and facilities may require electrical upgrades to support them. The EV taskforce will work to address these infrastructure siting barriers and to identify sufficient siting opportunities for EV chargers throughout the city. In addition, the taskforce will track and enforce implementation of Local Law 130 of 2013, which requires that new parking garages be equipped to accommodate EV charging equipment for at least 20 percent of parking spaces.

REDUCING FLEET EMISSIONS 50% BY 2025 AND 80% BY 2035

Light-duty vehicles: Near term (2015-2025)

- **Add 2,000 EV sedans to the fleet (outlined above): 9% GHG reduction**
  Replacing 2,000 light-duty vehicles with EVs, as described above, would shave 20 percent from current levels of gasoline consumption. This transition would displace roughly 2.5 million gallons of gasoline from annual consumption and reduce the City fleet's GHG emissions by 9 percent by 2025.

- **Adopt best practices in fleet management**
  Alongside discrete emissions reduction measures, the City can take steps to mitigate potential sources of fleet emissions increases through enhanced fleet management, particularly those policies that govern SUV procurement. A fuel-efficient hybrid sedan achieves over 100 percent better fuel economy than even a small SUV and is much less expensive to maintain. Sedans – which have historically comprised a majority of City passenger vehicles – are considered the default passenger vehicles for City operations. All requests for SUVs must be justified with a specific operational justification that is reviewed and approved by DCAS and the Office of Management and Budget. Any plans from agencies to upsize their vehicles will be accompanied by an acceptable agency plan to offset any incremental fuel use and emissions impacts that would result.

  City drivers and fleet managers can also improve the fuel efficiency of their driving better operational practices. Agencies should provide education and driver training to promote "ecodriving" measures to optimize the fuel efficiency of City vehicle travel, such as accelerating and decelerating slowly, anticipating the flow of traffic, and maintaining adequate tire pressure.

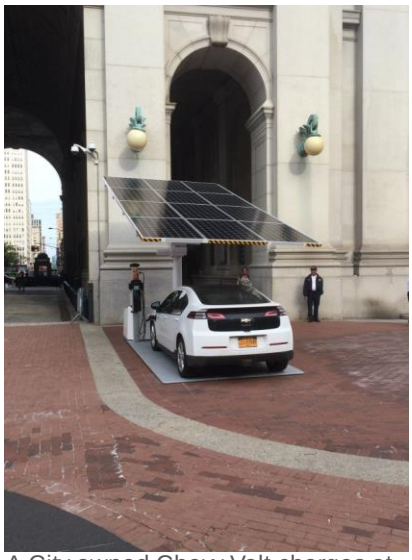
  The City can also foster a more fuel-efficient fleet by improving the utilization of dedicated agency vehicles to make vehicle travel more efficient. Accordingly, the City will investigate an expansion of the existing intra-agency car sharing program to incorporate more vehicles and potentially to span across agencies, as well as an exploration into prospects for ride-sharing. Solutions to improve fleet capacity utilization would not only cut costs but could also encourage environmental efficiencies by emphasizing more efficient vehicle use (i.e., shorter or combined trips).

Light-duty vehicles: Long term (2020 onward)

- **Deploy cutting-edge technologies to eliminate remaining light-duty fleet GHG emissions**
  Over a longer time horizon, the City will actively track and test technologies that can eliminate the remaining fossil fuel usage in its light-duty fleet. The sedan and SUV needs not initially subject to the EV roll-out, such as those of the NYPD and FDNY, may be satisfied by future technology that has not yet emerged to meet operational demands at scale in a cost-effective manner. To inform the set of available technological options, the City will issue an RFI in late 2015 to solicit responses from the marketplace on solutions intended to contribute large reductions in emissions from the City's fleet.

Some of the specific issues for light-duty applications that may be addressed in RFI responses include, but are not limited to:

- Expanded design and production of EV technologies, including advanced battery storage
- Ideas for implementing a charging infrastructure network in an urban environment, including solar carports
- Developments in hydrogen fueling and related infrastructure and how it may be applicable in New York City



A City-owned Chevy Volt charges at a solar carport outside the Municipal Building (source: DCAS)

Medium- and heavy-duty vehicles: Near term (2015-2025)

- **Expand usage of anti-idling, hybrid, and stop-start technologies: 5% GHG reduction**

  Much of the City's medium- and heavy-duty fleet consumes fuel while stopped during the course of routine operation. A range of technologies are now available as retrofit solutions that can reduce fuel waste without compromising the operational needs of particular vehicle types. In particular, anti-idling technologies are currently being deployed that avoid the need for FDNY ambulances to run their engines while stopped to power on-board services. Instead, alternative power units (APU) that are powered by the motor when in motion are being used to power these services, reducing or eliminating idling. APUs cost around $20,000 but have a reported payback period of roughly 18 months. FDNY is also now testing the feasibility of off-shore powering for on-board services, whereby ambulances can plug-in at predictable locations.

  Additionally, DSNY is piloting several technologies that can spare wasted fuel. One solution called "Neutral @ Stop," which disengages a collection truck's transmission when stopped, reduces the parasitic load on an engine and is estimated to conserve 3 percent of fuel demands. DSNY will now require Neutral @ Stop on all new collection truck purchases. A more nascent option is a stop-start system that shuts off the engine as a truck slows to a stop and uses electrical power generated during braking to restart the engine when needed. The Neutral @ Stop technology costs around $500 as a retrofit measure, and the stop-start system may be significantly more costly, though the price is expected to decline as it is used more widely. DOT is also in the process of procuring two hybrid front-end loader construction vehicles that can greatly reduce emissions. These fuel waste solutions can cut fuel needs and associated emissions by 30-35 percent.

  These technologies can be scaled up within and across agencies to reduce fuel waste from other vehicles that frequently idle in the course of standard operation. If one-third of the fleet's diesel-burning vehicles were retrofitted with fuel waste reduction measures, the City fleet could trim its GHG emissions by another 5 percent.

Medium- and heavy-duty vehicles: Near to long term (2015-2035)

- **Increase the use of diesel alternatives: 34% GHG reduction**

  The City's medium- and heavy-duty fleet already uses alternative fuels to some extent. All diesel trucks operated by City agencies currently run on biodiesel blends of at least 5 percent (B5). Many of these trucks use B20 during summer months when the fuel will not congeal. Compared to

conventional diesel, the combustion of biodiesel generates lower criteria air pollutant emissions, and the GHG impacts of biodiesel are negligible because it is a biogenic fuel source.

Accordingly, agencies with large diesel fleets (i.e., DSNY, DOT, DEP, Parks) can push the envelope on biodiesel, including testing higher blends (e.g., B50) during summer months and testing B20 whenever extreme cold does not prohibit its use. While manufacturers do not cover the use of biodiesel blends above B20 in vehicle warranties, the Department of Parks and Recreation has conducted three separate pilots using B50. Additional pilots to test the viability of higher biodiesel blends will help the City determine their viability for citywide fleet use. If such demonstrations are successful, the City will work with manufacturers to revise vehicle warranties to cover higher biofuel blends. If all diesel-burning fleet vehicles transition to year-round B20, with increased use of B50 during summer months, the City could reduce its emissions by 10 percent. Importantly, however, large-scale increases in City fleet biodiesel demand would require high-blend biodiesel infrastructure to be readily available to all agencies, which could require modifications to agency fueling depots.

In addition, more than 200 vehicles – including 44 DSNY collection trucks – currently run on CNG, which burns far cleaner than conventional diesel. However, the infrastructure upgrades to accommodate CNG safely (i.e., by providing adequate ventilation) are formidable. Biogas and renewable CNG present alternative opportunities to power City vehicles by closing a waste loop from waste sites throughout the city, but would still need to address safety and budgetary barriers. Still, if one-half of the diesel fleet transitioned to higher biodiesel blends and the other half upgraded to CNG engines, fleet emissions would fall by 14 percent.

Renewable diesel is a fuel not currently used by the City's fleet that could offer still greater GHG benefits and improved air quality. Produced through a distinct chemical process from biodiesel, renewable diesel has a virtually identical chemistry to conventional diesel, and is therefore compatible with existing diesel engines while avoiding the cold weather and warranty concerns that biodiesel faces. San Francisco has recently announced that it will transition its entire diesel fleet to 100 percent renewable diesel by the end of 2015, a transition facilitated both by regional proximity to production facilities in Asia and incentives under the California Low-Carbon Fuel Standard. While renewable diesel is not currently distributed in the northeast U.S., injecting it into the City's future fuel mix could result in large GHG benefits. If one-third of the City's diesel fleet used renewable diesel, while the other two-thirds used a mix of higher biodiesel blends and CNG, fleet GHG emissions could decline by 34 percent.

If, on the other hand, renewable diesel supply were to become abundant, New York could eradicate all conventional diesel consumption by using renewable diesel in all diesel vehicles. A transition of this magnitude would likely require large-scale changes to the City's fuel procurement arrangements, whether sourcing renewable diesel from other regions or developing local production capacity. An all-renewable diesel transition would accelerate the phase-out of conventional diesel to a near-term effort with even larger GHG and air quality benefits.

Medium- and heavy-duty vehicles: Long term (2020 onward)

- **Deploy cutting-edge technologies to eliminate diesel consumption**
  Clean technologies have begun to emerge that can eliminate emissions from even the heaviest of vehicles. Manufacturers are partnering with cities to deploy all-electric buses and sanitation trucks, and their technology is continually improving; Chicago began an all-electric collection truck pilot in

summer 2014. In the longer term, it is likely that emerging technologies will become ever more effective and cost-competitive and will be adopted into the City fleet in place of today's fossil-fuel burning trucks.

In addition to advanced batteries that can support larger vehicles over longer distances, hydrogen fuel cells bear similar potential. The RFI process described above will also assist the City in identifying promising technologies that can be tested in the medium term for long-term deployment at scale. Importantly, however, long-range technologies entail considerable uncertainty regarding the cost of large-scale deployment, production lead times, feedstock availability, and safety (e.g., hydrogen). Moreover, these technologies must be accepted by operators in order for agencies to meet their critical operating demands.

By embarking on the initiatives outlined above, and factoring in the fleet GHG emissions reductions already realized since 2005 (11 percent) and the gains to come from stricter EPA emissions standards, **New York City can cut the GHG emissions from its vehicle fleet in half relative to 2005 levels by 2025 and slash them by 80 percent by 2035**. As technologies improve and reduce barriers to low emissions that exist at present, it is possible that these initiatives will change and that targets can be met more quickly.

LEADING BY EXAMPLE FOR OTHER FLEETS

The New York City municipal government fleet is the single largest fleet in the city, but it contributes less than 4 percent of the city's total transportation-related GHG emissions. This underscores the importance of leveraging advances in City fleet sustainability to galvanize deeper emissions reductions for private fleets and other government fleets that operate in New York City.

To transfer sustainable practices from NYC Clean Fleet to the rest of the city's transportation sector, City fleet managers will partner with managers of private and other government fleets as well as nonprofit groups to provide a forum to share best practices and advance broader-based transportation sustainability initiatives. This initiative could include shared procurements and specifications, an expansion of the City's annual Fleet Show program, presentations by vendors, partnership on legislation, and recognition events.

Through this channel, the City can leverage its purchasing power and unique ability to innovate as a way to serve as an example for other fleets and the private sector to set the city on a path toward achieving its 2050 transportation sustainability goals.

[1] City of New York (2015), *One New York: The Plan for a Strong and Just City*, available online at http://www1.nyc.gov/html/onenyc/index.html.

[2] City of New York (2014), *Inventory of New York City Greenhouse Gas Emissions - November 2014*, available online at http://www.nyc.gov/html/planyc/downloads/pdf/NYC_GHG_Inventory_2014.pdf.

[3] GHG emissions reductions are estimated according to the GHG accounting conventions of the Local Government Operations Protocol (LGOP), which is used to generate the *Inventory of New York City Greenhouse Gas Emissions*. Because LGOP excludes emissions from biogenic fuels from Scope 1 emissions per IPCC *Guidelines for National Greenhouse Gas Inventories*, eligible solutions include not only those that generate zero or near-zero tailpipe emissions, such as electric vehicles, but also those with tailpipe emissions that are offset by carbon dioxide uptake during fuel feedstock growth, such as biofuels.

[4] Coal plant equivalency uses average emissions factors (1.09 tCO_2/MWh, 0.001 tNO_x/MWh) and capacity factor (0.38) from EPA eGRID 2012, available online at http://www2.epa.gov/energy/egrid. Tree planting equivalency derived from EPA's GHG equivalencies calculator, available online at http://www2.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references.

[5] On-road transportation excludes public transit.

[6] U.S. Environmental Protection Agency (EPA) (2008a), *Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks*, available online at http://www.epa.gov/otaq/consumer/420f08024.pdf.

[7] U.S. Environmental Protection Agency (EPA) (2008b), *Average In-Use Emissions from Heavy-Duty Trucks*, available online at http://www.epa.gov/otaq/consumer/420f08027.pdf.

[8] Federal standards require average fleet efficiency for cars and light-duty trucks to reach 54.5 miles per gallon by model year 2025, and require fuel economy in medium- and heavy-duty trucks to improve 10 to 20 percent by model year 2018, depending on vehicle category. See the National Highway Traffic Safety Administration's fuel economy webpage at http://www.nhtsa.gov/fuel-economy.

[9] Sources for U.S. cities: City of Cambridge – https://www.cambridgema.gov/CDD/climateandenergy/municipalsustainability/greenfleet (Cambridge); Clean Technica – http://cleantechnica.com/2014/07/11/bay-area-governments-make-americas-biggest-yet-electric-vehicle-buy/ (San Francisco Bay Area); Electric Cars Report – http://electriccarsreport.com/2015/08/city-of-atlanta-launches-us-largest-municipal-electric-vehicle-fleet/ (Atlanta); Electrification Coalition – http://www.greenhoustontx.gov/ev/Houston_Case_Study_2013.pdf (Houston); Examiner.com – http://www.examiner.com/article/mayor-emanuel-adds-commitment-to-electric-and-alternative-fuel-vehicle-for-fleet (Chicago); IndyStar – http://www.indystar.com/story/news/politics/2014/10/28/mayor-greg-ballard-plans-electric-vehicles/18062225/ (Indianapolis); LA Times – http://www.latimes.com/local/lanow/la-me-ln-la-electric-vehicles-20150911-story.html (Los Angeles); Rocky Mountain Institute – http://blog.rmi.org/blog_2015_07_08_smart_charging_in_seattle (Seattle); U.S. Department of Energy – http://www.afdc.energy.gov/case/2143 (Sacramento).

[10] Sources for international cities: Automotive Fleet – http://www.automotive-fleet.com/news/story/2013/08/oslo-to-take-delivery-of-1-000-evs-during-vehicle-record-attempt.aspx (Oslo); Inhabitat – http://inhabitat.com/shenzhen-china-launches-the-worlds-largest-electric-vehicle-fleet/ (Shenzhen); International Energy Agency – https://www.iea.org/publications/freepublications/publication/EVCityCasebook.pdf (Barcelona, Shanghai); International Energy Agency – https://www.iea.org/topics/transport/subtopics/electricvehiclesinitiative/EVI_2014_Casebook.pdf (Hangzhou); Seoul Metropolitan Government – http://www.automotive-fleet.com/news/story/2013/08/oslo-to-take-delivery-of-1-000-evs-during-vehicle-record-attempt.aspx (Seoul); Sustainia – http://issuu.com/sustainia/docs/cities100/ (Nanjing); Transport for London – http://content.tfl.gov.uk/ulev-delivery-plan.pdf (London).