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INVENTORY OF NEW YORK CITY GREENHOUSE GAS EMISSIONS

DECEMBER 2013

A GREENER, GREATER NEW YORK

The City of New York
Mayor Michael R. Bloomberg

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Cover Photo: Panorama of the Lower Manhattan Skyline and Waterfront
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A GREENER, GREATER NEW YORK

Foreword by Michael R. Bloomberg, Mayor of New York City

One year ago, New York City and the surrounding region tragically experienced the effects of a changing climate when Hurricane Sandy devastated our city. Even before this disaster, we knew that climate change presented enormous challenges. Since 2007, when we launched PlaNYC to build a greener, greater New York, we have worked diligently to increase our city's resilience to the effects of a changing climate, while also mitigating our own greenhouse gas emissions.

Now, for the seventh straight year, we are publishing an inventory of GHG emissions attributable to activities within New York City. Each year, we report the results of our GHG mitigation efforts to document the impact of investments we have made and the efficacy of the policies we have developed and implemented. We have made tremendous progress in reducing GHG emissions from citywide sources as well as City government operations, but we still have a great deal of work ahead of us.

In the last seven years, cities around the world have followed New York's lead by developing and implementing their own sustainability plans. While cities are generally less carbon-intensive than rural areas per capita, Cities are still responsible for as much as 70 percent of global GHG emissions. In recent years, we have seen little to no action on the national or international front to address the world's ever-rising GHG emissions, but cities are taking action, and they are showing results.

We set an ambitious GHG reduction goal in PlaNYC: to reduce citywide GHG emissions by more than 30 percent below 2005 levels by 2030, and we also committed to measure and report our progress through annual GHG inventories. We continue to refine our work and increase our analytical rigor. For the first time, this year's inventory reports GHG emissions from buildings at the neighborhood level and estimates life cycle GHG emissions associated with the consumption of goods and services by New York City residents.

This year's GHG inventory, which reports 2012 GHG emissions, shows that we have again reduced citywide GHG emissions and that we are almost two-thirds of the way toward achieving our target. GHG emissions reductions from City government operations and properties are also two-thirds of the way toward their reduction goal, putting us on track to achieve our 30 percent reduction target by 2017.

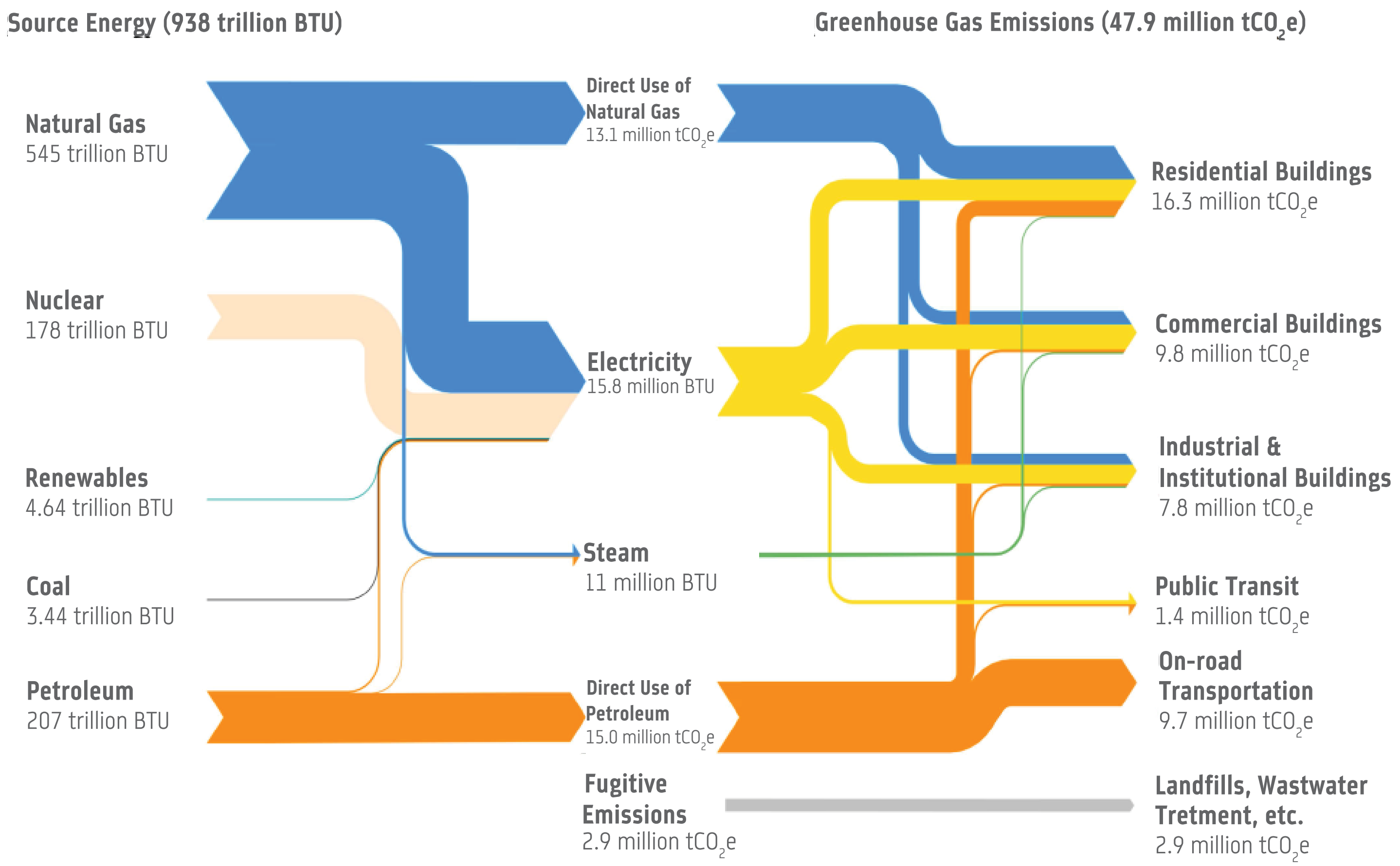
We have made a commitment to create a greener, greater city for the present and future, and in doing so, we are achieving dramatic reductions in our own contributions to global GHG emissions that imperil our environment and economy.

Mayor Michael R. Bloomberg

New York City Energy Use and Greenhouse Gas Emissions

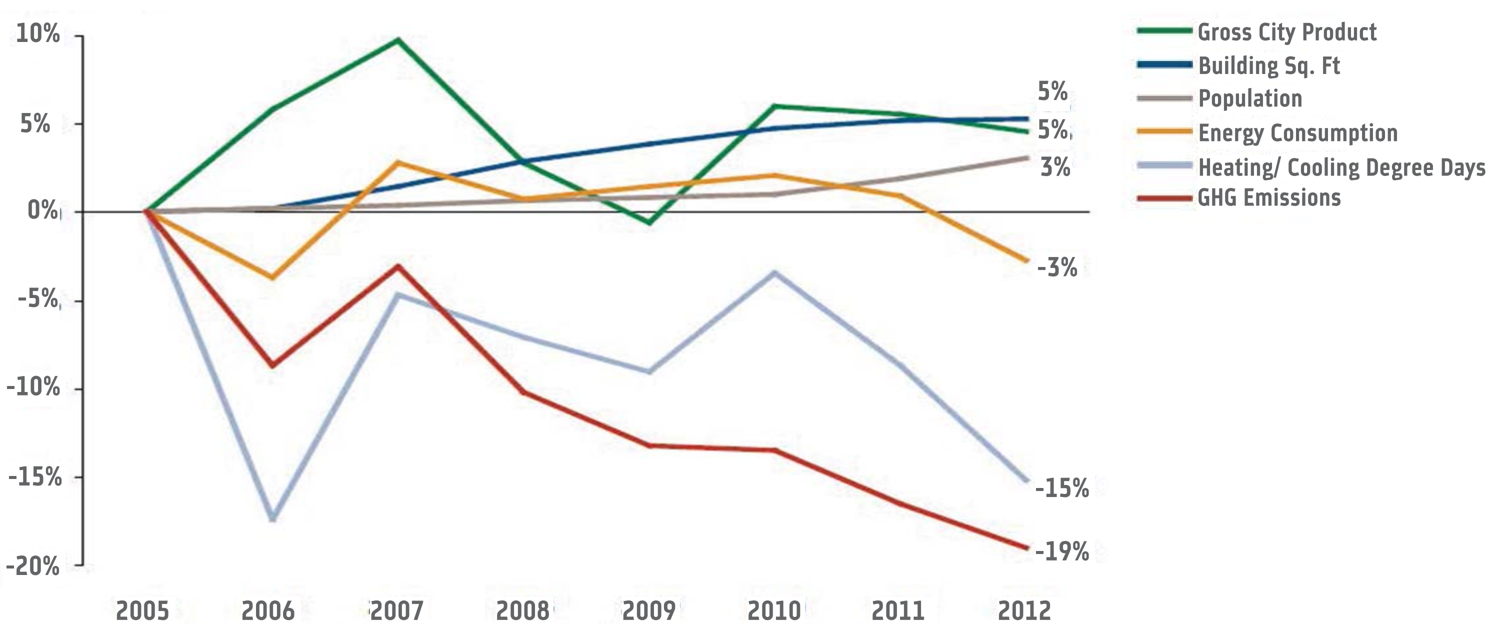
NYC Buildings are responsible for 74 percent of citywide greenhouse gas emissions through the use of heating fuel, natural gas, electricity, and steam. The transportation sector accounts for 21 percent and remaining emissions stem largely from fugitive emissions released at landfills and wastewater treatment plants.

Fig. 1: 2012 New York City Energy Consumption and Greenhouse Gas Emissions



Source: NYC Mayor's Office

Fig. 2: Energy, GHG Emissions, and Economic Indicators: Indexed to 2005



Source: NYC Mayor's Office

Executive Summary

New York City reduced its greenhouse gas (GHG) emissions by 19 percent since 2005 and is almost two-thirds of the way toward achieving the PlaNYC goal of a 30 percent reduction by 2030. Cleaner generation of electricity and steam were responsible for the majority of emissions reductions, and New Yorkers are using electricity and heating fuel more efficiently in their buildings.

Human activities such as industrial processes, fossil fuel combustion, and changes in land use have altered the balance of greenhouse gases in the Earth's atmosphere. As New York experienced only one year ago with Hurricane Sandy, the Earth's climate and weather patterns have responded to such changes, with increases in the frequency and intensity of extreme weather events, loss of animal and plant species, impacts to human health, disruption of ecosystems, and other effects.

New York City recognized the importance of doing its part to mitigate these serious consequences of climate change in 2007 with the release of its comprehensive sustainability plan, PlaNYC, which established the goal of reducing New York City's GHG emissions by 30 percent below 2005 levels by 2030. The City also set a more ambitious goal for GHG emissions from City government operations, pledging to reduce GHG emissions from these sources by 30 percent below Fiscal Year (FY) 2006 levels by 2017. Both goals are codified in law and through Executive Order, requiring the City to produce an annual assessment and analysis of GHG emissions from the city as a whole and government operations.

This inventory reports on two inter-related sets of data: GHG emissions attributable to all activities occurring within the five boroughs of the City of New York, which are aggregated as the "citywide" GHG inventory (referred to as "community" in relevant GHG protocols), and the subset of GHG emissions attributable to operation of New York City's government, such as the energy used to heat schools and propel fire trucks, and fugitive GHG emissions that result from wastewater treatment and solid waste disposal, which are aggregated as the "City government" GHG inventory.

This inventory reports annual levels of GHG emissions and reports the causes of variations in emissions levels over time. By measuring and analyzing GHG emissions, the City is able to track the progress it is making toward achieving many of the sustainability policy measures outlined in PlaNYC, such as improving buildings' energy efficiency, cleaning the city's power supply, creating low-carbon transportation options, and reducing GHG emissions from City government buildings, wastewater treatment, solid waste disposal, and other sources.

Citywide emissions changes from 2005 to 2012:

- Citywide emissions were 19 percent lower in 2012 than 2005, almost two-thirds to the PlaNYC goal of a 30 percent reduction by 2030 (See Fig. 3)
- Reduced carbon intensity of the city's electricity supply was the largest driver of GHG emissions reduction, reducing GHG emissions by more than 6.6 million metric tons (or 11 percent)
- Local economy, population, and building square footage have grown while total energy consumption has decreased slightly
- New Yorkers reduced electricity and heating fuels use per unit of building floor area, and reduced per capita vehicle use and solid waste generation
- Fugitive sulfur hexafluoride (SF_6) emissions from electricity distribution decreased significantly

Reductions in energy use per unit of building area indicate that New Yorkers used energy more efficiently in 2012 than in 2005, a sign that PlaNYC's initiatives are beginning to take effect.

Electricity used in buildings (generated both in and out of the city) remains the largest source of GHG emissions related to activities in New York City. Given this, the reduced carbon-intensity of the city's electricity supply is the largest driver of citywide GHG emissions reductions from 2005 to 2012 and the largest driver of City government GHG emissions reductions from FY 2006 to FY 2012. This reduction is the result of increased natural gas-fired generation displacing more carbon intensive oil- and coal-fired generation; investments in new and cleaner generation; the retirement of coal-fired and other inefficient generation; and several other factors. Market forces along with local, state, and federal policies all contributed to the change in the fuel mix of the city's electricity supply since 2005.

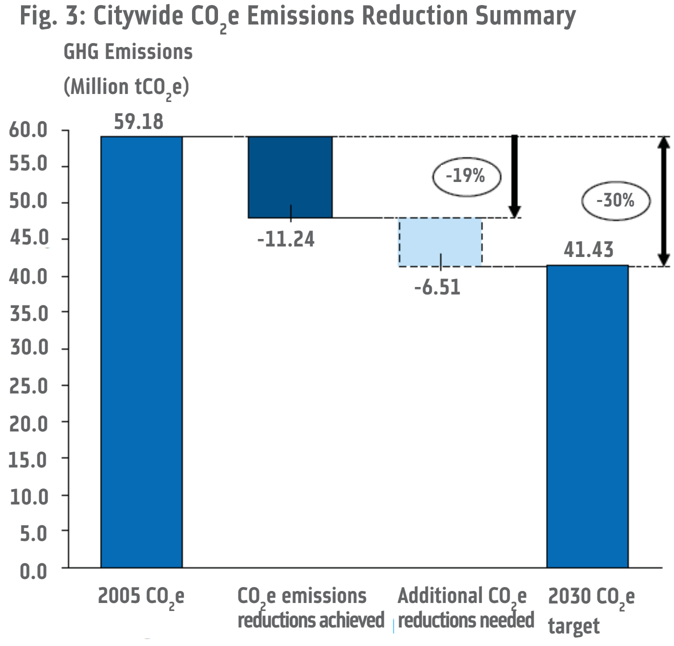
City government emissions changes from fiscal year 2006 to fiscal year 2012:

- City government emissions were 19 percent lower in FY 2012 than FY 2006, almost two-thirds of the City's goal of a 30 percent reduction by 2017 (see Fig. 4)
- Increased heating fuel efficiency was the largest driver of GHG emissions reduction (see citywide bullet 2)
- Electricity use in buildings decreased beyond growth, reflecting the impact of energy efficiency investments and improved building operations
- Buildings reduced emissions from heating through the decreased use of more GHG intensive heating oil with a corresponding increase in natural gas and steam
- Transportation fleets decreased emissions through the adoption of alternative fuel and more fuel efficient vehicles, and fleet size reduction measures such as mode shifting solid waste transport from trucks to less GHG intensive railroad and barge
- Landfills within the city produced less methane and captured more fugitive methane
- Streetlights used less electricity through conversions to LED technology while maintaining their vital services

The significant reductions in City government GHG emissions—especially over the last year—indicate that the City's efforts to meet its PlaNYC goal of a 30 percent reduction in government emissions below FY 2006 levels by FY 2017 are now beginning to pay off. After several years of concerted effort and substantial commitment of City resources, the City's investments in energy efficiency upgrades to its buildings and fugitive GHG emissions reductions laid out in the Long-Term Plan to Reduce Municipal Energy and Greenhouse Gas Emissions of Municipal Buildings and Operations are showing notable results.

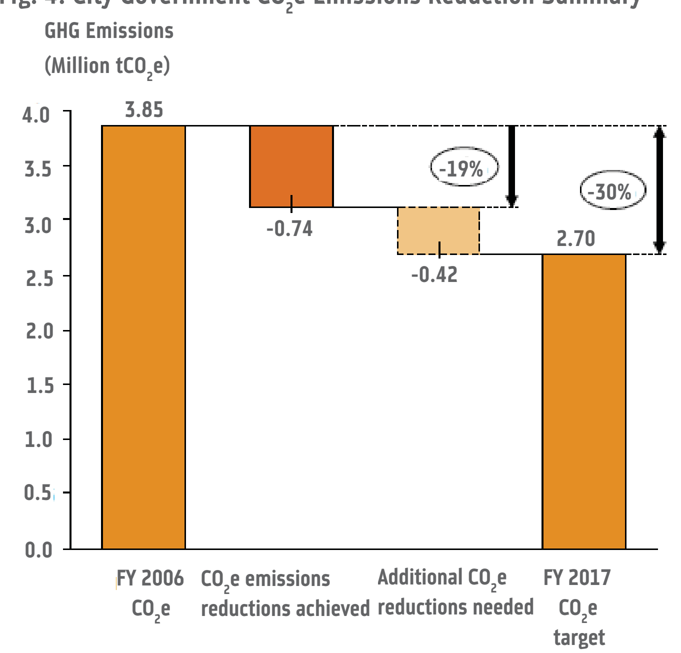
Reduced carbon intensity of the city's electricity supply has been a principal driver of changes to both citywide and City government emissions to date. However, many of PlaNYC's GHG mitigation initiatives are showing results and are projected to make additional contributions toward achieving the City's GHG mitigation targets in coming years. City investments in energy efficiency retrofits, additional and improved landfill methane capture, the reduction of methane leaks at wastewater treatment plants, heating fuel switching from fuel oil to natural gas in buildings, and improved vehicle fleet fuel economy have all contributed to reducing City government GHG emissions. Benchmarking and the reduction of energy use by large buildings in the city; the passage of regulations to phase out the use of heavy fuel oil in the city's buildings; the commitment of leading universities, hospitals, Broadway theaters, and commercial tenants to reduce energy; and the revision of building codes to require energy savings have led to reductions in citywide GHG emissions.

Fig. 3: Citywide CO_2e Emissions Reduction Summary



Source: NYC Mayor's Office

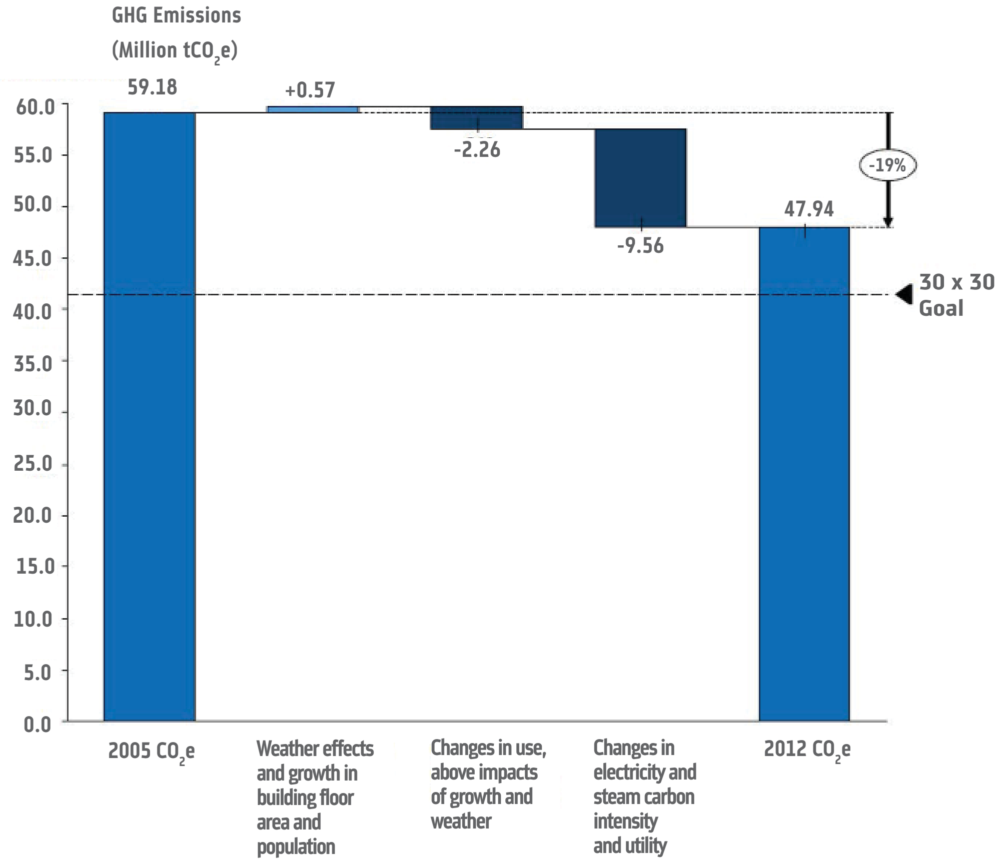
Fig. 4: City Government CO_2e Emissions Reduction Summary



Source: NYC Mayor's Office

Fig. 5: 2005 to 2012 New York Citywide GHG Emissions Drivers

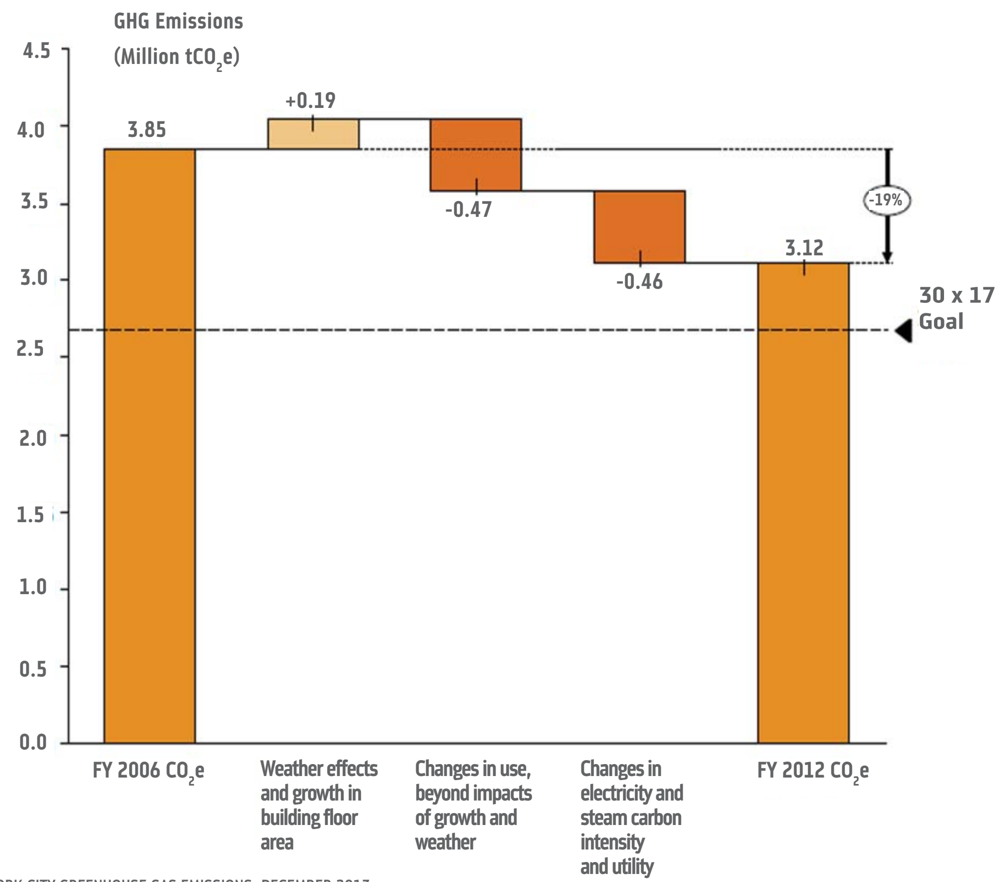
From 2005 to 2012, New York City reduced per building area energy use and per capita vehicle use and solid waste generation, while a cleaner electricity supply drove down GHG emissions.



Source: NYC Mayor's Office

Fig. 6: FY 2006 to FY 2012 New York City Government GHG Emissions Drivers

From FY 2006 to FY 2012, New York City government reduced its own energy use, while a cleaner electricity supply drove down GHG emissions.



Source: NYC Mayor's Office

Introduction

New York City reduced citywide greenhouse gases for the fifth consecutive year and is almost two thirds toward its PlaNYC reduction target of 30 percent by 2030.

The City of New York's comprehensive sustainability plan, PlaNYC, set the goal in 2007 of reducing citywide (community) greenhouse gas emissions 30 percent below 2005 levels by 2030. This goal was set following rigorous analysis that determined it was both ambitious and achievable, assuming the use of current technology. The 2011 PlaNYC update reaffirmed this goal. In implementing PlaNYC, Mayor Bloomberg signed Executive Order 109 in October 2007, mandating even more aggressive greenhouse gas mitigation for municipal government operations and facilities of 30 percent below fiscal year (FY) 2006 levels by 2017.

The City released its first comprehensive greenhouse gas inventory in April 2007 (2005 Inventory), which informed both the citywide and City government greenhouse gas mitigation efforts and established the levels from which the City's greenhouse gas mitigation goals are based. Local Law 22 of 2008 requires the City to update both the citywide and City government inventories annually and to document the progress the city is making toward achieving its greenhouse gas mitigation goals. The City released its first annual greenhouse gas inventory update in September 2008 (2007 Inventory) , and released annual updates in September 2009 (2008 Inventory) , October 2010 (2009 Inventory) , September 2011 (2010 Inventory) , and December 2012 (2011 Inventory) . This document (2012 Inventory) is the City's sixth annual greenhouse gas inventory update.

The City of New York has become a global leader in the development and implementation of new carbon accounting methodologies. OLTPS has represented the City and municipal governments in general on steering and advisory committees responsible for developing standards for regional, national, and international carbon accounting and mitigation tracking methodologies and approaches. These standards continue to evolve and each year the city incorporates new and emerging carbon accounting procedures. In addition, new data and revised calculations require continuous revisions to past year's inventory results. As such, both the citywide and City government base year and interim year inventory results are updated where applicable, reflecting current methodologies and better data and allowing for more accurate comparability across multiple years. The reliance on increasingly rigorous analysis to inform the City's greenhouse gas mitigation strategies provides strong evidence for the City's data-driven approach to management: you cannot manage what you do not measure. This document demonstrates clearly the value of this approach.

While the 30 x 30 goal is an important one to strive toward, it is clear that far deeper carbon reductions are necessary for New York City and the globe. Recognizing the importance of developing strategies to achieve carbon reductions beyond current goals and to lead by example, the City is exploring options to accelerate its 30 percent greenhouse gas mitigation target and the feasibility of achieving even deeper carbon reductions of 80 percent by 2050.

The City continues to support efforts to standardize greenhouse gas measurement and reporting methodologies, and this document is completed per the guidance published in several protocols. City government emissions are calculated and reported per the Local Government Operations Protocol (LGOP). Several efforts are underway to develop community-level municipal greenhouse gas protocols: ICLEI-Local Governments for Sustainability (ICLEI), C40 Cities Climate Leadership Group (C40), the World Bank, and the World Resources Institute (WRI) Global Protocol For Community-Scale Greenhouse Gas Emissions (GPC) ; ICLEI – Local Governments for Sustainability USA U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (USCP) ; and the New York State Energy Research and Development Authority (NYSERDA) New York State Regional Greenhouse Gas Protocol. This inventory is consistent with each of these guidance documents, where appropriate and applicable. Upon final publication and any revisions to these protocols, the City will update its methodology and results in future inventory updates.

The development and adoption of new greenhouse gas measurement and reporting methodologies provides new opportunities to represent greenhouse gas emissions associated with cities. One area of emerging analysis is consumption-based emissions, which attempts to estimate the greenhouse gas emissions associated the consumption of goods and materials. This approach differs significantly from New York City's historic greenhouse gas emissions accounting approach, based principally on the use of energy and characterized as a production-based inventory. A consumption-based inventory allows a city to communicate the full life cycle GHG emissions impact of its residents' consumption of goods and services, demonstrating the effect consumption decisions may have on GHG emissions occurring beyond a city's borders. For the first time, this inventory includes an estimate of New York City's GHG emissions from household consumption.

New York City is a very large city with an extremely diverse portfolio of buildings. Energy use and GHG emissions vary widely in different regions of the city, influenced by building age, type of construction, use, socioeconomics, and other factors. To show how energy use and GHG emissions differ through New York's many different neighborhoods, this inventory for the first time estimates the level of emissions from buildings by zip code.

Citywide Inventory

Citywide GHG emissions were 3.0 percent lower in 2012 than in 2011 because of milder weather, reduced energy use in buildings, and reduced vehicle use. From 2005-2012, total energy use has declined while the local economy, population, and building floor area have increased.

New York City's 2012 citywide GHG inventory is completed in adherence to current international standards and practices, prior City GHG accounting practices and precedents, and emerging and new GHG accounting and reporting protocols, where applicable and appropriate. The City supports the use of all applicable protocols and standards, and results are presented in accordance with different standards in the Appendix. The 2012 citywide GHG inventory is consistent with past reported GHG inventories to allow for continued comparability. Any deviations from past practices are noted.

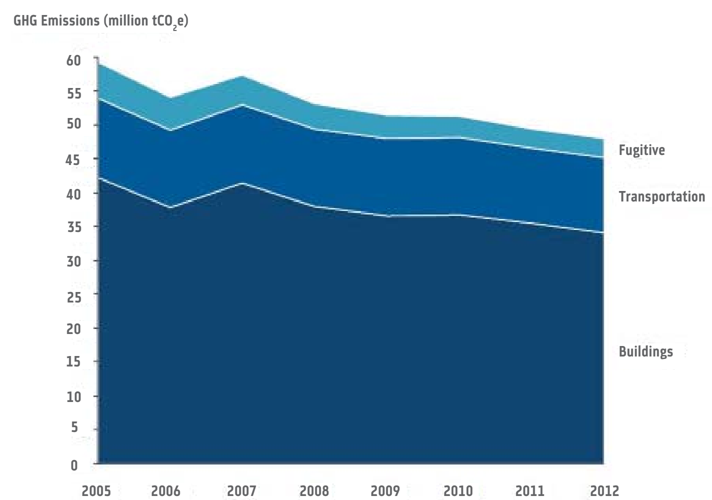
This citywide GHG inventory consists of all direct and indirect GHG emissions from energy used by buildings and other stationary sources, on-road transportation, and public transit (excluding aviation and marine transportation) within the geographic borders of New York City; fugitive GHG emissions from wastewater treatment, in-city landfills, solid waste disposed of out of the city, and electricity and natural gas distribution within New York City; and GHG emissions associated with the transportation of solid waste outside of the city.

Citywide 2012 inventory results

Total 2012 GHG emissions in New York City were 47.9 million metric tons of carbon dioxide equivalent ($MtCO_2e$), 19 percent below 2005 base year GHG emissions of 59.2 $MtCO_2e$, and 3.0 percent below 2011 GHG emissions of 49.4 $MtCO_2e$.

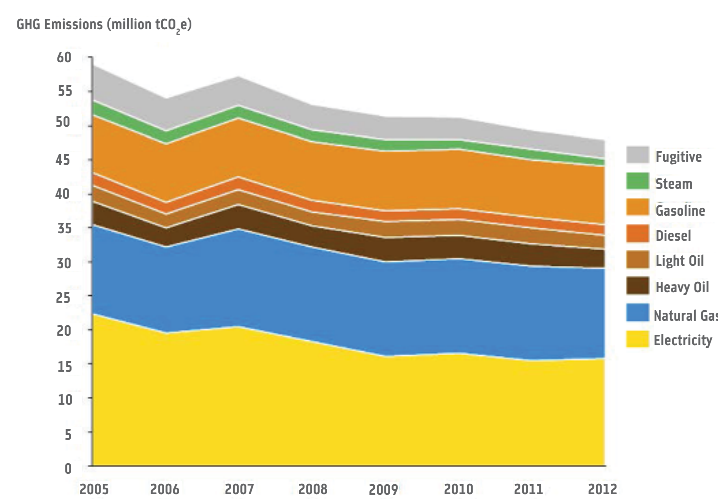
- **Scope 1 GHG emissions:** 29,004,460 tCO_2e (direct emissions from on-site fossil fuel combustion or fugitive emissions from within the city's boundary)
- **Scope 2 GHG emissions:** 16,919,318 tCO_2e (indirect emissions from energy generated in one location, but used in another, such as electricity and district steam)
- **Scope 3 GHG emissions included in the city's total emissions results:** 2,015,252 tCO_2e. (indirect emissions that occur outside the city's boundary as a result of activities within the city's boundary, e.g. emissions from exported solid waste)
- **Scope 4 GHG emissions not included in the city's total**

Fig. 7: 2005 to 2012 Citywide Annual GHG Emissions by Sector



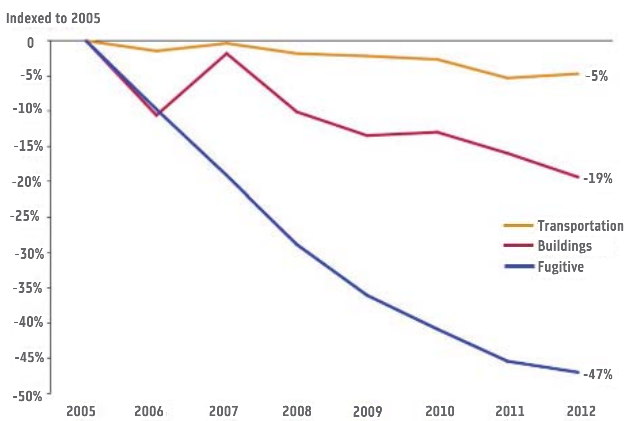
Source: NYC Mayor's Office

Fig. 8: 2005 to 2012 Citywide Annual Emissions by Source



Source: NYC Mayor's Office

Fig. 9: 2005 to 2012 Changes in Citywide GHG Emissions



Source: NYC Mayor's Office

emissions results: 15,426,643 tCO_2e (e.g. emissions from domestic and international aviation), reported as information items only

- **Additional emissions reported as information items only, not counted toward the city's total emissions results:** 572,992 tCO_2e (e.g. biogenic emissions from combustion of biofuel)

Changes to citywide emissions

The City assessed factors that might affect interannual changes to citywide GHG emissions. Some factors, such as weather, population growth, increased building floor area, and changes to the carbon intensity of electricity and steam generation, are external factors beyond the City's control. However, tracking changes to these factors allow the City to model drivers that indicate the impact of City GHG mitigation policies, such as per capita transit use or per square meter energy use, and allow the City to tailor future GHG mitigation initiatives most effectively. This summary analysis reports on citywide changes from all sectors—the sector-specific sections of this chapter report the results of detailed analysis of changes within each sector.

2005-2012 changes

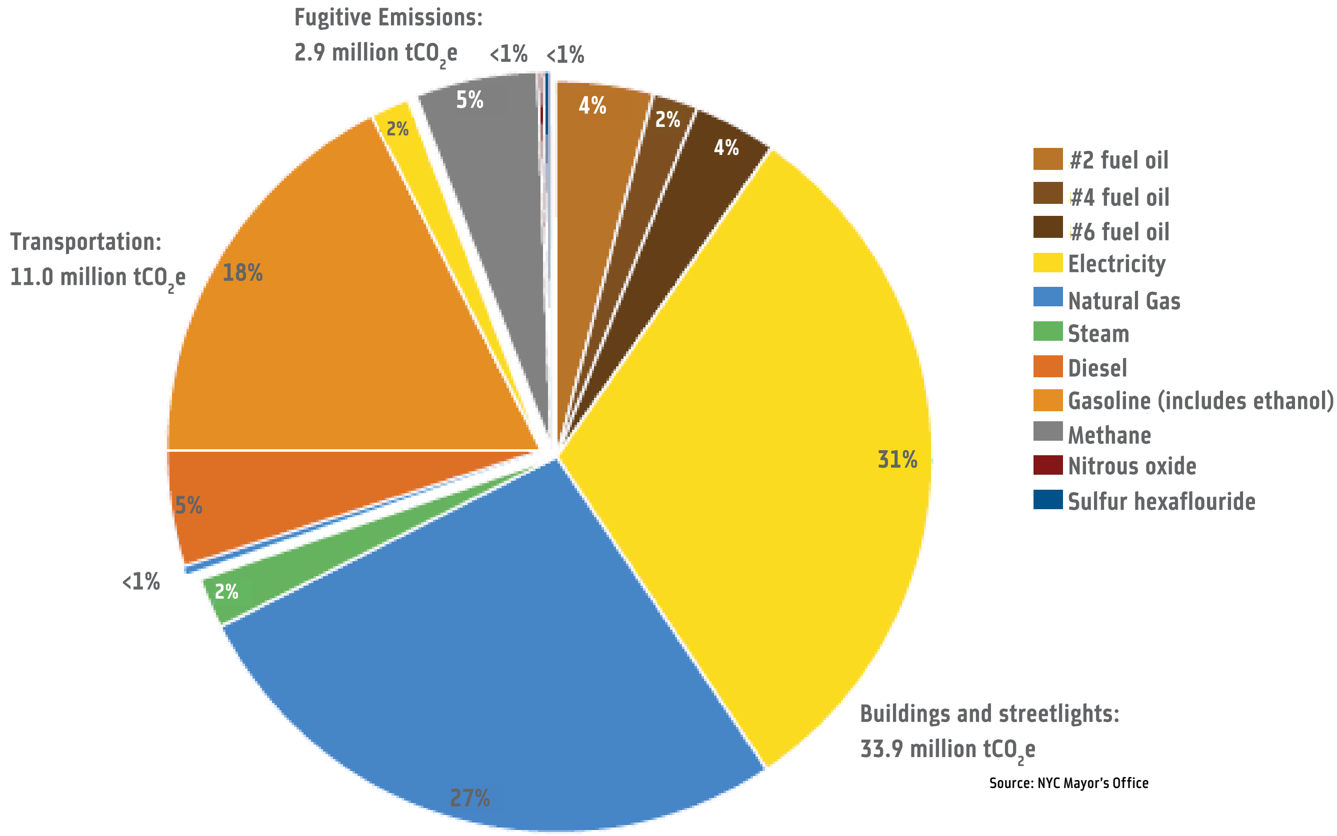
Citywide GHG emissions were 19.0 percent lower in 2012 than in the 2005 base year, almost two-thirds of the way toward the City's 30 percent reduction target in just six years. Milder summer and winter weather, reduced energy use per unit of building floor area, reduced carbon intensity of electricity and steam generation, reduced SF_6 emissions from electricity distribution, reduced vehicle use, and reduced solid waste generation were most responsible for this reduction. Increased population and building floor area offset this reduction. If weather, building and population growth, and electricity and steam generation carbon intensity are excluded, overall GHG emissions decreased in this period by 7.4 percent.

As reported in recent GHG inventories, New Yorkers continue to demonstrate that they are becoming more efficient and less wasteful , as electricity and heating fuel use per unit of building floor area, per capita vehicle miles traveled, and per capita solid waste generation decreased in 2012 below 2005 levels. In this period, the gross city product grew by 4.5 percent (0.6 percent CAGR), population grew 3.0 percent (0.4 percent CAGR), and building floor area grew 5.3 percent (0.7 percent CAGR), while total energy use declined. (see Fig. 9)

2011-2012 changes

Citywide GHG emissions decreased 3.0 percent from 2011 to 2012, driven by a milder winter and summer, reduced electricity and heating fuel use per unit of building floor area, reduced on-road vehicle use, increased use of co-generation for district steam, increased methane capture at wastewater treatment plants (WWTPs), and decreased fugitive SF_6 emissions from electricity distribution. Growth in population and buildings, a slight increase in per capita solid waste generation and transit use, and an increase in the carbon intensity of the city's electricity supply offset these reductions. When weather, growth, and changes to the carbon intensity of the city's electricity and steam supply are excluded, citywide GHG emissions decreased by 1.9 percent. Figure 11 presents the details of these changes.

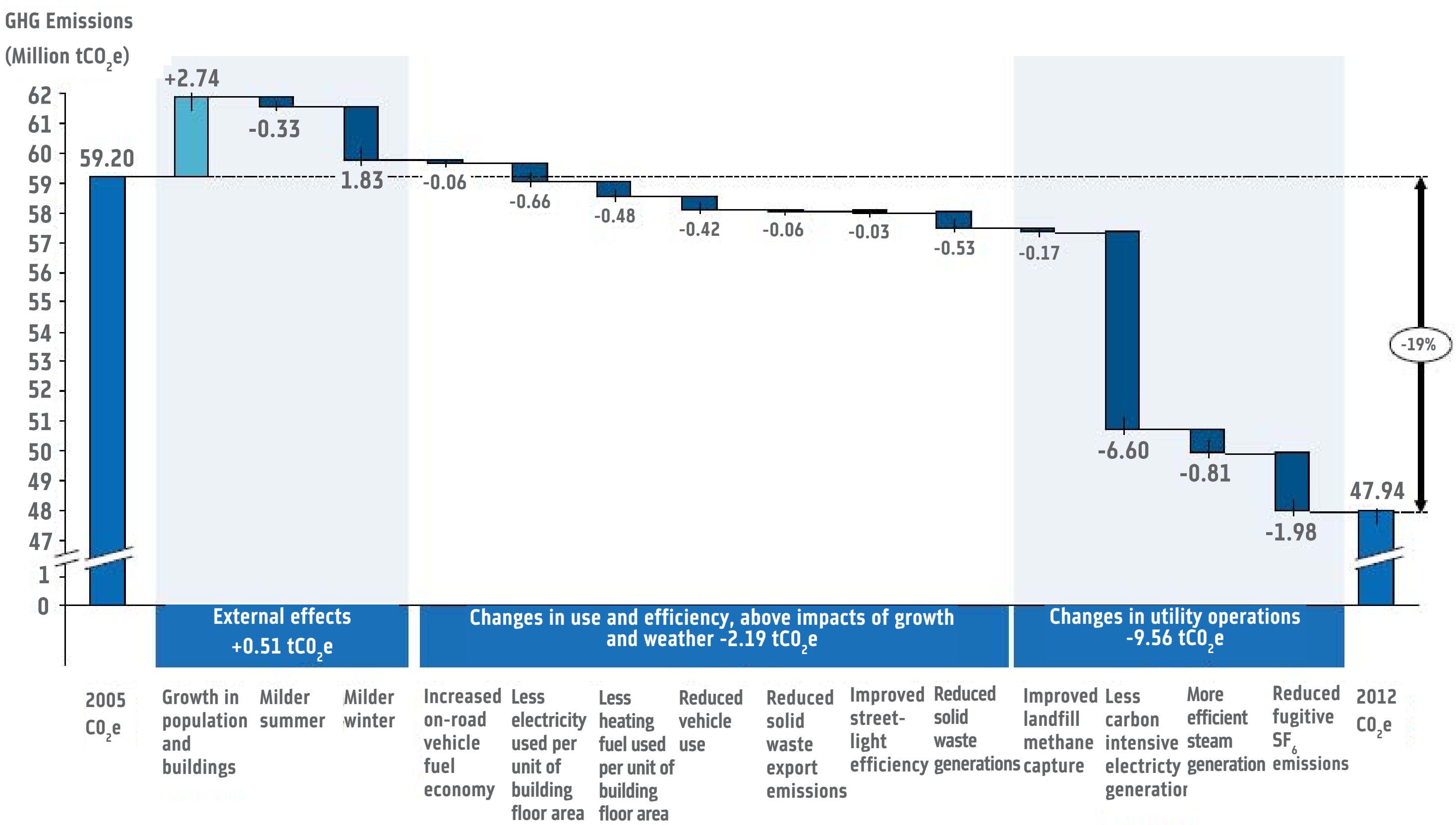
Fig. 10: 2012 Citywide GHG Emissions by Sector and Source



Source: NYC Mayor's Office

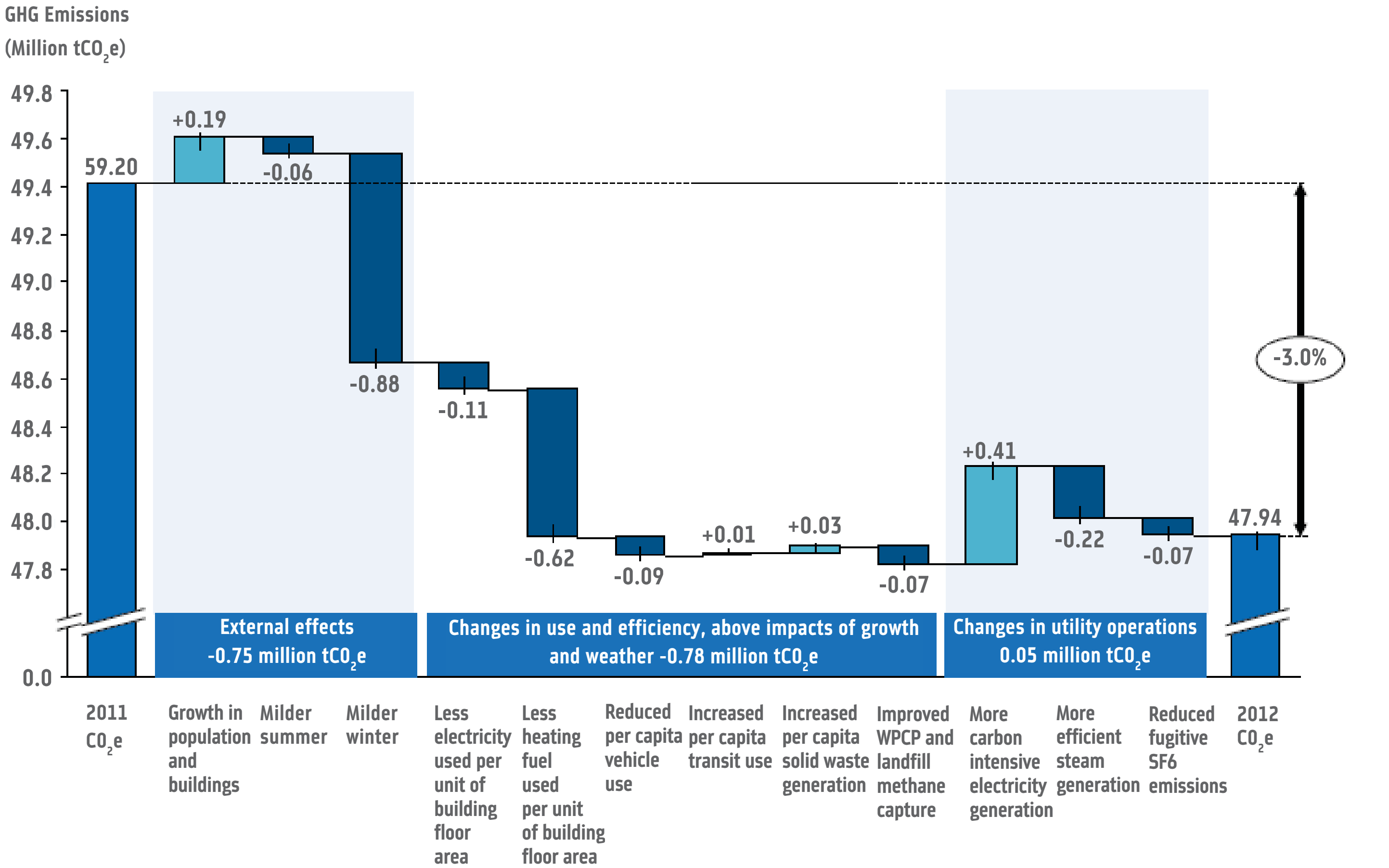
Fig. 11: 2005 to 2012 GHG Emissions Drivers

From 2005 to 2012, milder weather, less heating fuel and electricity use, less solid waste generation and a cleaner electricity supply drove the largest reductions in GHG emissions.



Source: NYC Mayor's Office

Fig. 12: 2011 to 2012 Changes in New York City GHG Emissions



Source: NYC Mayor's Office

Citywide methodology for analysis of change

The City calculated changes in GHG emissions and energy use in each sector to determine how factors driving changes, such as growth, weather, and changes in carbon intensity of the city's electricity and steam supply affect GHG emissions. The change in population was applied to all non-building emission sources, while the change in building floor area was applied to building sector emissions sources to determine the collective net impact these factors had on GHG emissions. The City conducted regression analyses for each building energy source using data on monthly energy use and heating degree and cooling degree days to determine the correlation of weather to building energy use. This correlation was used to calculate the change in energy use beyond that resulting from changes in weather. The results of this analysis determined the expected use of electricity, fuel oil, natural gas, and steam for each year, which were divided by the use of each energy source in the earlier year for each period to determine a weather impact factor. This factor was then multiplied by the building's energy use for each source to determine the impact weather had on the use of building energy use (due to data availability City government steam and fuel oil use was used as a proxy for citywide use). The results of regression analyses for electricity, natural gas, steam, and fuel oil are shown in Appendix G.

Per capita and per unit of building floor area trends were determined by subtracting the rate of overall population (for non-building sectors) and building floor area change and the weather impact factor, and the carbon intensity change from the change in GHG emissions for each energy source in each sector. The impact of revisions and updates to electricity and steam coefficients was determined by calculating the change in carbon intensity for each energy source in each sector, and multiplying this factor by the percentage that each energy source in each sector contributed to the inventory total. All citywide data sources are detailed in Appendix K.

Citywide GHG Emissions by Sector

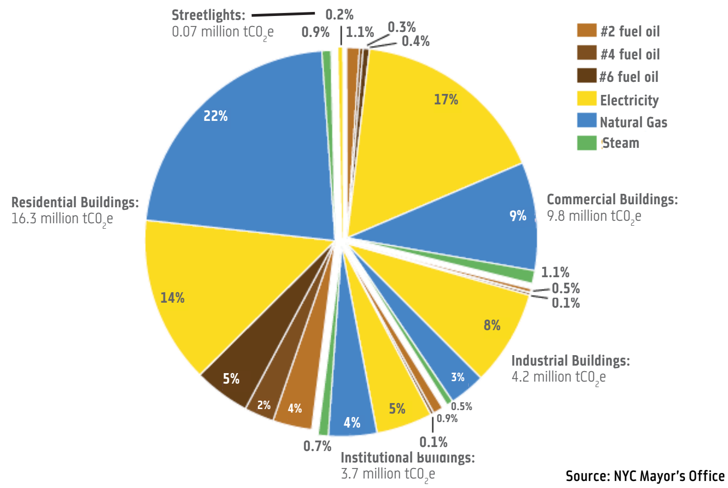
Buildings

New York City's building stock is massive and diverse, ranging from small single-family homes to some of the world's largest skyscrapers. The operation of these buildings is responsible for the majority of the city's GHG emissions. This enormous building stock presents a prime opportunity for GHG mitigation measures, and the City has focused many of its GHG mitigation policies on the city's existing buildings, 75 percent of which are estimated to still be in existence by 2030.

The City's Greener, Greater Buildings Plan (GGBP) is a suite of local laws targeted toward the city's largest buildings – those larger than 50,000 square feet (or campuses of buildings totaling more than 100,000 square feet). Among the GGBP's mandates is a requirement that large building benchmark their energy and water use annually, demonstrating their energy efficiency. Initial data developed through this law shows that energy use varies greatly between building types, uses, and locations in the city. Some buildings use five times as much energy per unit of floor area as other buildings with similar uses.

Since 2005, GHG emissions from buildings have declined 19 percent, driven by a reduction in the carbon intensity of the city's electricity supply and milder weather, but also as a result of less energy use per unit of building floor area. As shown in Figure 14, GHG emissions from energy consumption per unit of floor area declined by more than 1.1 million tCO_2e since 2005, a 3 percent reduction in buildings emissions and 14 percent of the total GHG reduction from this sector.

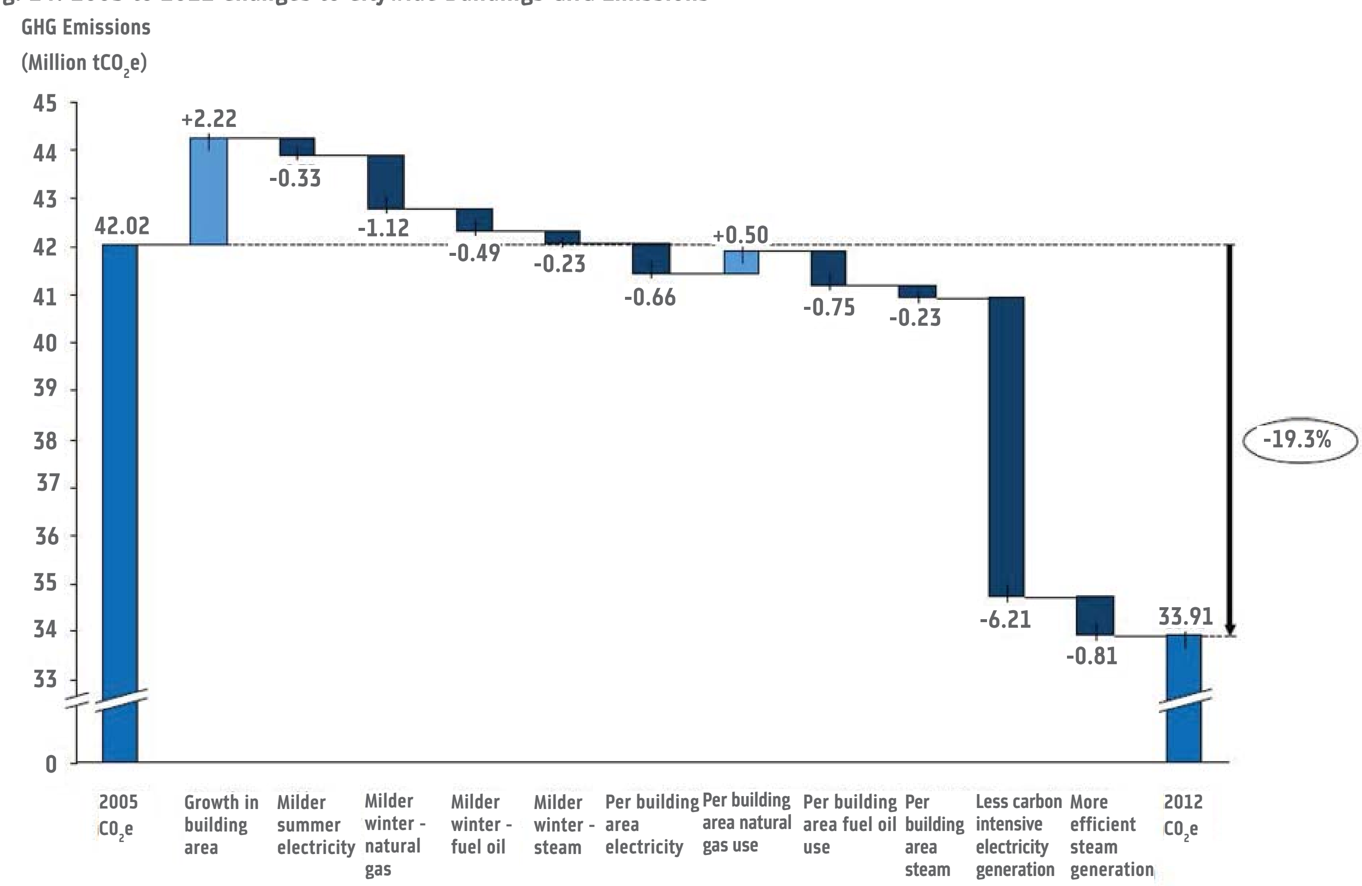
Fig. 13: 2012 Citywide Buildings & Streetlights Emissions by Source



Source: NYC Mayor's Office

Of particular importance is the reduction in GHG emissions from fuel oil per unit of building floor area, and the corresponding increase from natural gas per unit of building floor area, resulting in a net reduction of 0.25 million tCO_2e. This evidence of fuel switching is due to both the construction of new buildings (which use natural gas), and to the City's Clean Heat Program, which is designed to phase out the use of heavy heating oil.

Fig. 14: 2005 to 2012 Changes to Citywide Buildings GHG Emissions



Source: NYC Mayor's Office

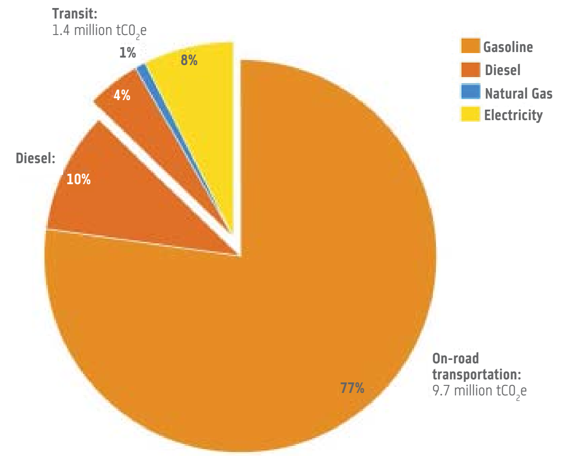
Transportation

New York City has one of the world most extensive mass transit systems in the world, with subways, buses, commuter railways, and ferries contributing to the city's low per capita GHG emissions levels. The city is also home to more than two million vehicles, the operation of which accounted for 20 percent of the city's total GHG emissions in 2012. Transportation sources resulted in 11.0 million tCO_2e in 2012. Improved fuel economy of the city's vehicles, reduced carbon intensity of the electricity supply serving the city's subways and commuter trains, and reduced per capita vehicle miles driven by cars and trucks led to a reduction of 0.49 million tCO_2e since 2005, a 4.2 percent reduction from transportation sources and accounting for a 0.8 percent reduction in 2005 overall citywide GHG emissions.

Since 2005, the fuel economy of the city's light truck fleet (sport utility vehicles and pick-up trucks) decreased slightly. Increased fuel economy for heavy trucks and buses during this period offset this, resulting in a net reduction of 0.06 million tCO_2e.

The city's subway and commuter rail system used more than 5 percent of all electricity used in the city in 2012. As such, the large decrease in the carbon intensity of the city's electricity supply over the last seven years led to a reduction of 0.35 million tCO_2e, after accounting for the impact of population growth.

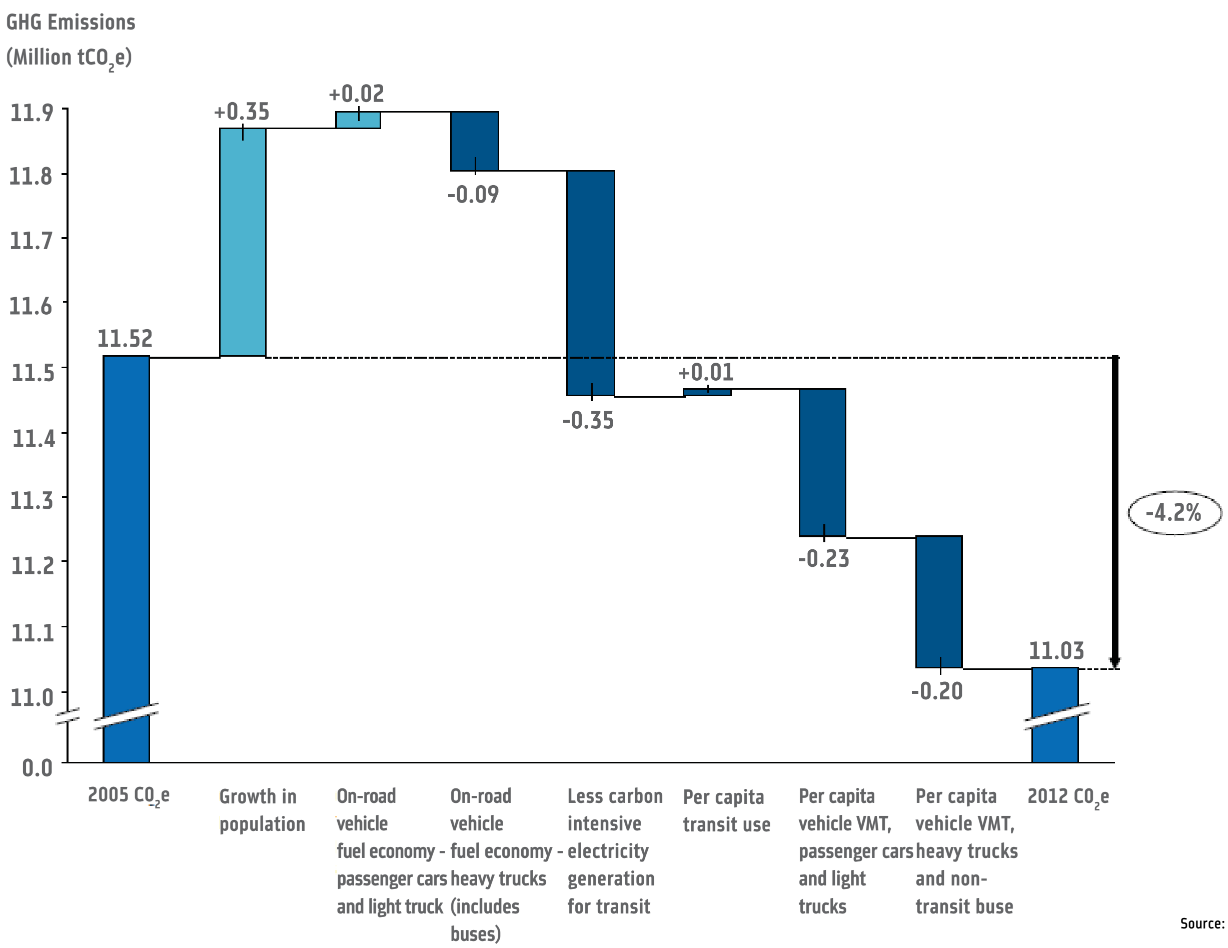
Fig. 15: 2012 Citywide Transportation Emissions by Source



Source: NYC Mayor's Office

Per capita transit use also increased slightly during this time, leading to an increase in GHG emissions from transit-related sources. This was offset by a decrease in per capita vehicle use, with a new GHG emissions reduction of 0.42 million tCO_2e.

Fig. 16: 2005 to 2012 Changes to Citywide Transportation GHG Emissions



Source: NYC Mayor's Office

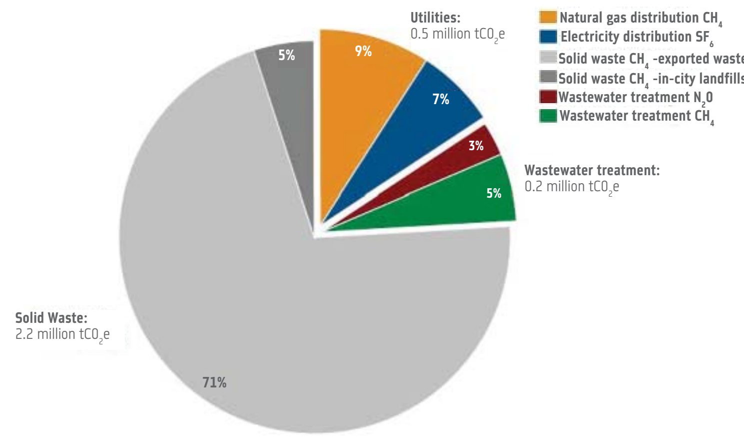
Solid Waste, Wastewater, Fugitive Emissions

New York City's residents, workers, and visitors generate more than 20,000 tons of solid waste and use more than 1 billion gallons of water each day. The management of this solid waste, treatment of wastewater, and distribution of natural gas and electricity was responsible for 2.8 million tCO_2e of fugitive methane, nitrous oxide, and sulfur hexafluoride emissions. Between 2005 and 2012, fugitive GHG emissions from these sources decreased by 2.5 million tCO_2e, or 47 percent. Emissions from solid waste management alone declined by 0.68 million metric tons, decreasing 23 percent (including GHG emissions from the transportation of exported residential solid waste).

As New York City's six in-city landfills are closed and no longer accepting solid waste, methane generation from these facilities is steadily decreasing as the waste decomposes. One landfill, the Brookfield Avenue Landfill on Staten Island, is now in the final stages of installing a landfill gas capture system. When complete, fugitive methane emissions from this facility will decrease dramatically. Total in-city landfills GHG emissions dropped by 0.16 million tCO_2e from 2005 to 2012, a 54 percent reduction.

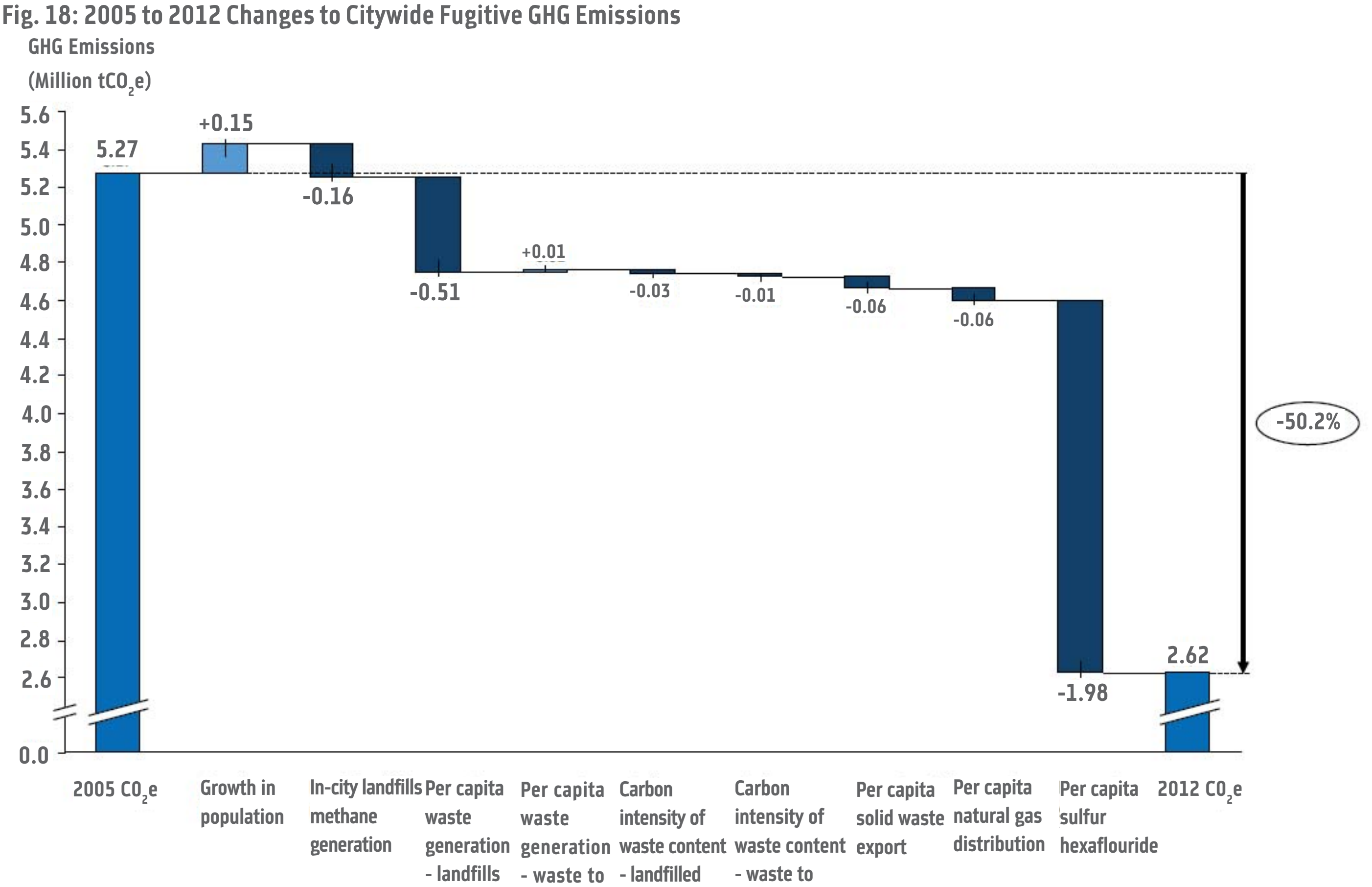
The City is seeking to divert the percentage of solid waste it sends to landfills by 75 percent by 2030. Efforts including increased recycling, increased waste-to-energy disposal, and increased composting have led to a 19 percent reduction in the amount of solid waste sent to landfills from 2005 to 2012. After accounting for an increase in population, this change is responsible for a 0.51 million tCO_2e reduction over this period. Because the carbon intensity of waste management systems depends on the composition of the waste stream, a reduction in the percentage of organic material sent to landfills between 2005 and 2012 resulted in a 0.03 tCO_2e reduction, and a slight increase for waste sent to waste-to-energy facilities led to an increase in GHG emissions from this source.

Fig. 17: 2012 Citywide Fugitive GHG Emissions

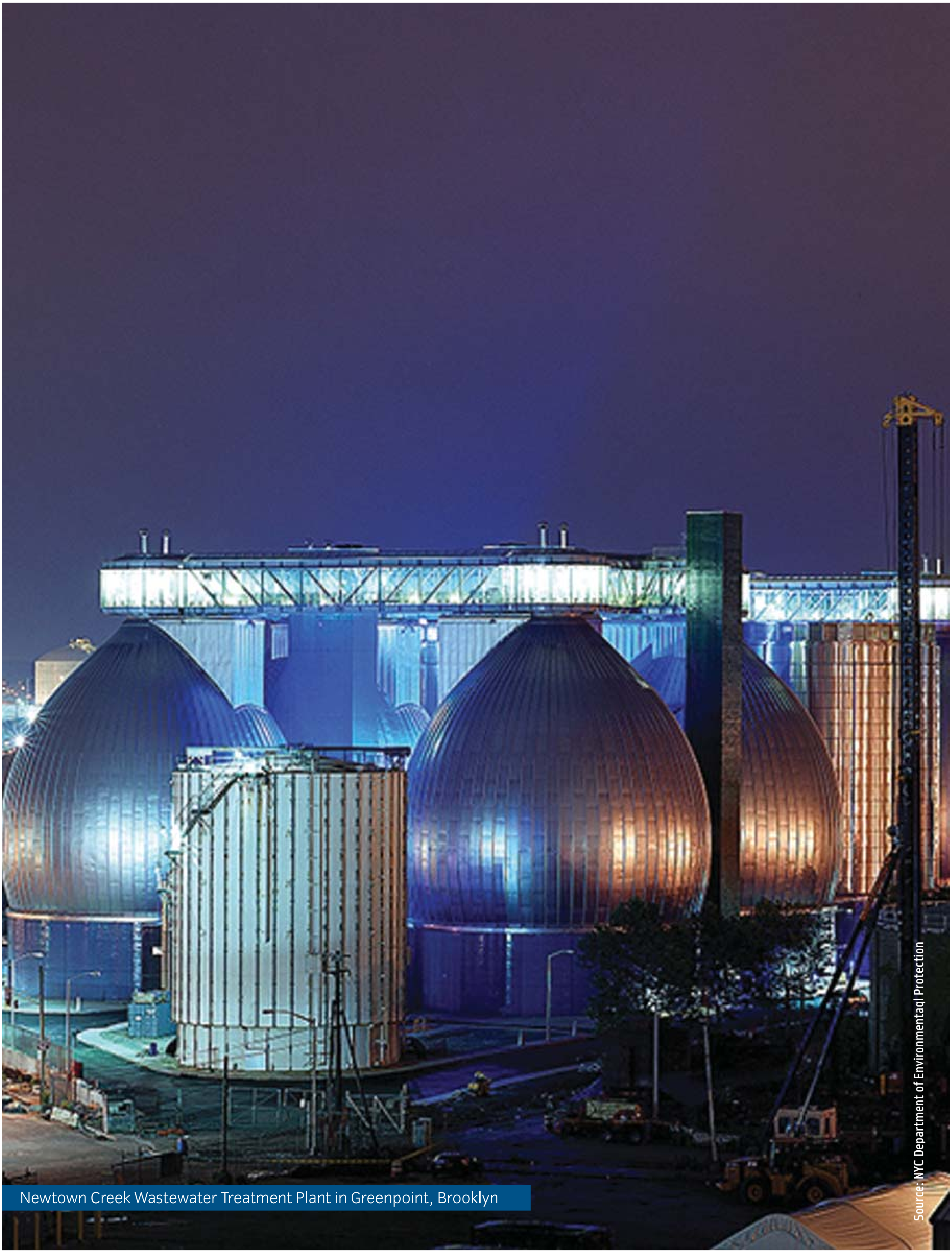


Source: NYC Mayor's Office

Fig. 18: 2005 to 2012 Changes to Citywide Fugitive GHG Emissions



Source: NYC Mayor's Office


Newtown Creek Wastewater Treatment Plant in Greenpoint, Brooklyn

Source: NYC Department of Environmental Protection

Emerging Methodology for Evaluating Lifecycle Emissions

New York City is a very large, populous, and diverse city. Measuring and reporting total GHG emissions for the entirety of New York as one community does not illustrate that different levels of GHG emissions are generated, and at different rates, throughout the city. To understand the variations in GHG emissions at different areas of geography better, the City compiled location-specific energy use data from utilities for electricity, natural gas, and steam, and modeled fuel oil use based on fuel oil vendor reported deliveries and the City's own database of fuel oil boiler permits. While the focus on residential buildings' GHG emissions only accounts for one-third of citywide GHG emissions, it did allow the City to complete an initial assessment of the location and intensity of a major portion of citywide GHG emissions.

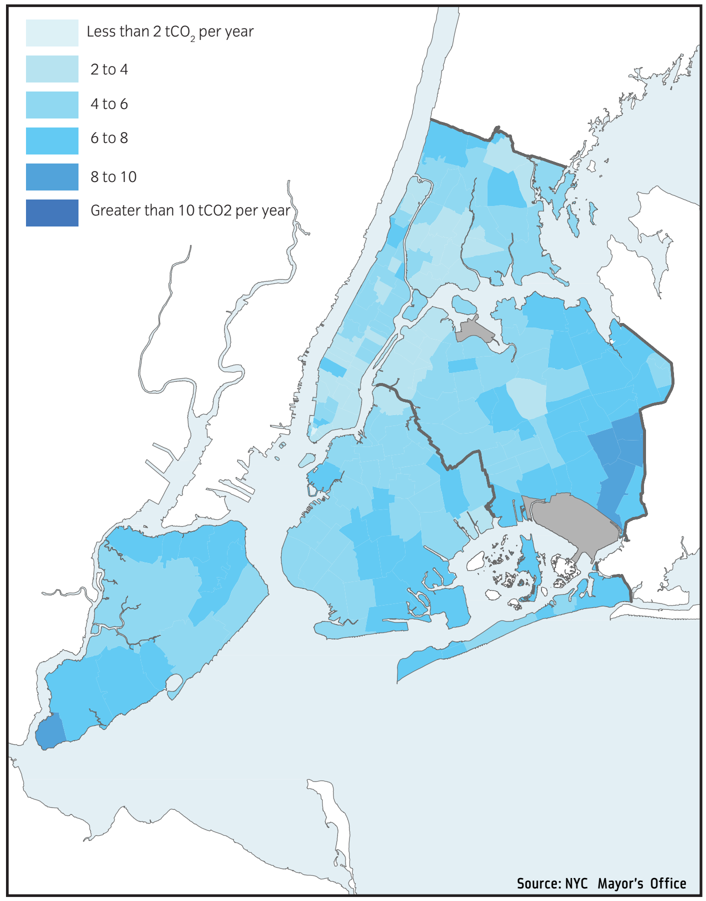
Production- vs. Consumption-based Inventory

Past GHG inventories were completed according to accepted practice at the time of publication, focusing principally on GHG emissions associated with energy and transportation use, solid waste generation and wastewater treatment, and fugitive emissions. This accounting approach is known as a production-based GHG inventory and is closely aligned with the approach prescribed in the Greenhouse Gas Protocol Corporate Standard (GHG Protocol), which is the foundation upon which all international GHG accounting and reporting standards are based.

While the production-based accounting approach allows for an accurate and comparable estimate of GHG emissions produced within a city's boundary, it fails to account for the full life cycle GHG emissions associated with city residents' use of materials and services, including "upstream" GHG emissions. A consumption-based GHG emissions inventory will provide a more complete estimate of GHG emissions related to activities within a city, and can serve as a valuable educational tool used to influence consumer behavior.

The U.S. Community Protocol provides guidance to assist with the completion of consumption-based inventories. Based on this guidance, the City of New York assessed GHG emissions related to household consumption, focusing on the activities of residents living within New York City. This assessment was based on a tool developed by the University of California-Berkeley, augmented with New York City-specific data where applicable. Preliminary results indicate that a consumption-based approach could more than double the city's attributable emissions, moving accountability away from producers outside of the city to consumers inside the city. While this tool provides a useful estimate of GHG emissions associated with household consumption, it is a new tool that is still evolving, and future versions are likely to provide more refined results. Nonetheless, the City has chosen to include the results of this analysis in an attempt to demonstrate a more comprehensive understanding of GHG emissions associated with New York City.

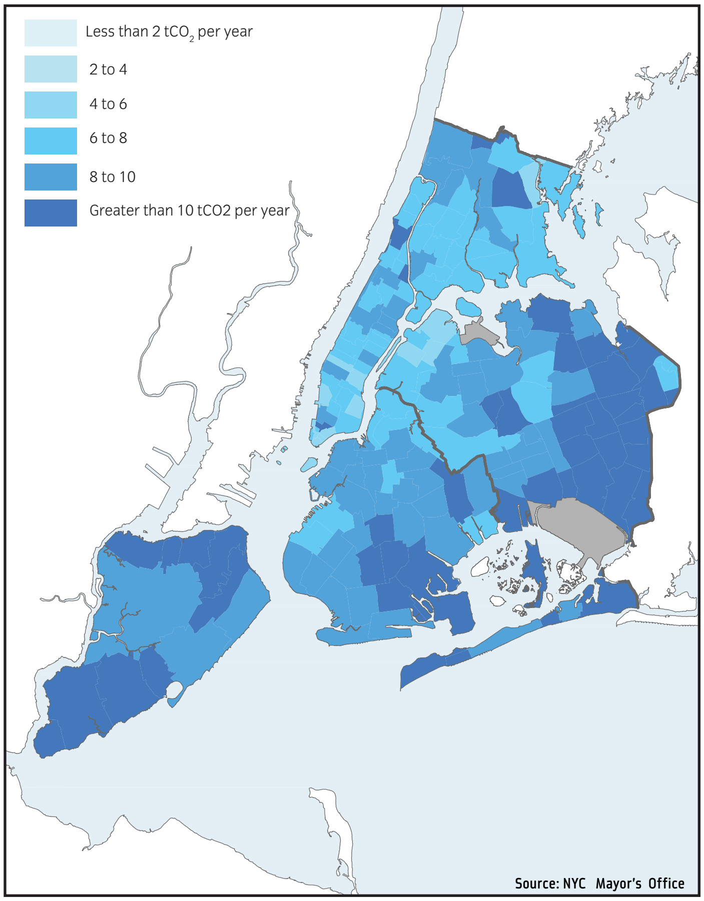
Production-based Inventory (Current Methodology): Household Emissions



CoolClimate divides emissions from household consumption into five categories, each of which includes sub-categories representing the various direct and indirect emissions attributable to them. Housing accounts for energy generation and use (natural gas, fuel oil, electricity), the construction of the home, water consumed, and waste generated.

Some relevant data points include each zip code's population density; average household size, age, and income; average number of rooms and year of home construction; average cost of energy; and more. The data is derived from a combination of sources, including the U.S. Census Bureau's American Community and Housing Surveys; the U.S. Bureau of Labor Statistics' Consumer Expenditure Surveys; various public and private entities like the U.S. Environmental Protection Agency (EPA), universities, and energy utilities, which provide energy consumption values, formulas, or constants for calculations; and more. As such, there are multiple assumptions inherent in the model that are reflected in the Household Consumption Map.

Consumption-based Inventory (Lifecycle Emissions): Household Emissions



Methodology

Data used to report zip code-level GHG emissions were from private, City, and federal sources. Where applicable, data for zip codes for individual residential buildings were incorporated into encompassing zip codes to maintain customer confidentiality. Utilities provided energy use data by billing service class. The City uses this methodology to distribute energy use among different building types.

Consolidated Edison (ConEd) provided data at the zip code-level on citywide electricity use, steam use in Manhattan, and natural gas use in the Bronx, Manhattan, and parts of Queens. These data were derived from ConEd's customer billing database.

National Grid provided zip code-level natural gas use data for Brooklyn, parts of Queens, and Staten Island. As with ConEd, these data were provided from National Grid's customer billing system. Because of potential variations in reported use that may result from billing periods overlapping the calendar, reported volumes were adjusted based on reported annual natural gas sendout figures and unaccounted-for gas (UFG) leakage figures to more accurately reflect actual use during the calendar year period.

The Long Island Power Authority (LIPA) reported data on electricity use for the Rockaways areas of Queens, consumption was distributed into each of the Rockaways zip codes using building floor area ratios derived from the New York City Department of City Planning (DCP) PLUTO database.

Where only Commercial building consumption was reported, the values were portioned into Commercial, Industrial, and Institutional buildings while accounting for DCP's building square footage weights and multiplying by energy consumption assumptions made using U.S. Census Bureau data. Similarly, when only a general Residential building consumption was provided, the amounts were split into Large Residential and Small Residential buildings using the same methods.

Fuel oil use was estimated using fuel oil boiler permit data from the New York City Department of Environmental Protection (DEP), joined with the PLUTO database to approximate the amount of fuel oil burned per square foot of building floor area. The resulting fuel oil intensity was used to assign citywide fuel oil use, as provided by fuel oil suppliers, to zip codes.

Heating energy type distribution percentages were extracted from the 2007-2011 American Community Survey 5-Year Estimate and compared with the data received from the above utilities and agencies. Information on household size, household income, and population were also obtained from the U.S. Census Bureau.

Values for number of buildings, floors, units, and floor area for each building type in each zip code were calculated using DCP's PLUTO database.

Adjustments based on land area proportions had to be made for the 11001 and 11040 zip codes which are located partially in East Queens and partially outside of Queens (outside of the New York City geopolitical boundary). Energy use for LaGuardia Airport, and John F. Kennedy Airport zip codes were omitted.

The U.S. Postal Service's (USPS) zip codes differ from the Census Bureau's zip code tabulation areas (ZCTAs) with respect to the total number of zip codes in NYC and to the land area that each zip code covers. The CoolClimate model only provides emissions for the Census Bureau's ZCTAs, and New York City energy use is reported by utilities using USPS zip codes. As such, there were roughly 12 zip codes for which household emissions were assumed to be the average of surrounding zip codes.

City Government Inventory

City government GHG emissions were 9.3 percent lower in FY 2012 than FY 2011 because of milder weather, reduced energy use in City buildings, improved methane capture at wastewater treatment plants, less carbon-intensive steam generation, and reduced vehicle emissions.

New York City's government uses large amounts of energy each year to provide services to millions of city residents, businesses, commuters, and visitors. The city's municipal buildings, WWTPs, and vehicle fleet are responsible for the majority of City government GHG emissions, while landfills, the transportation of solid waste, operation of streetlights and traffic signals, and the water supply system account for the remainder

This New York City government GHG inventory is calculated and reported in accordance with the LGOP and reports GHG emissions from operations, facilities, or sources wholly owned by the City or over which the City has full authority to introduce and implement operations, health and safety, and environmental policies (including both GHG- and non-GHG-related policies). GHG emissions from leased real estate and vehicles and other equipment are included. It is important to note that additional non-City operated public entities (e.g. the MTA) are not included by this definition of operational control.

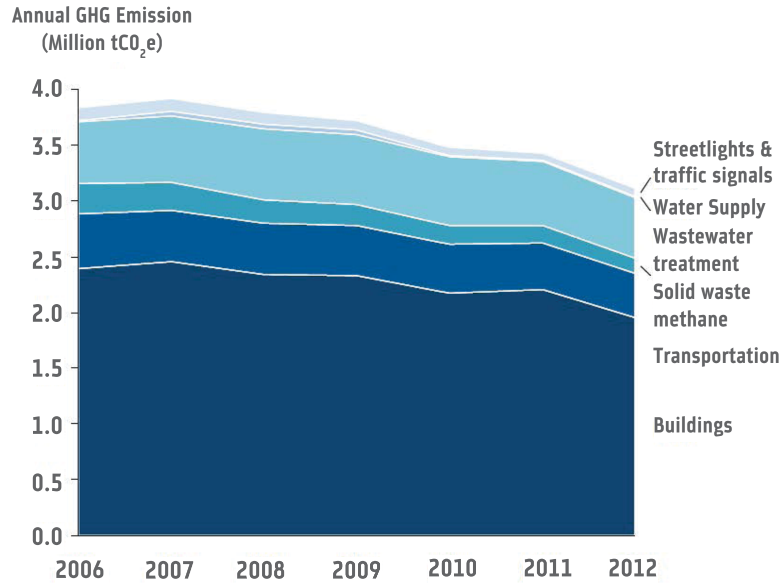
City government FY 2012 results

New York City's government GHG emissions were 3.12 $MtCO_2e$ in FY 2012, resulting in a 9.3 percent decrease from FY 2011 and a 19.1 percent decrease from FY 2006 base year levels. FY 2012 GHG emissions are broken down as follows:

- **Scope 1 GHG emissions:** 1,718,070 tCO_2e,
- **Scope 2 GHG emissions:** 1,398,883 tCO_2e,
- **Scope 3 GHG emissions:** 362,520 tCO_2e,
- **Additional emissions but not counted toward the city's total emissions results** (e.g. biogenic emissions from combustion of biofuel): 14,103 tCO_2e.

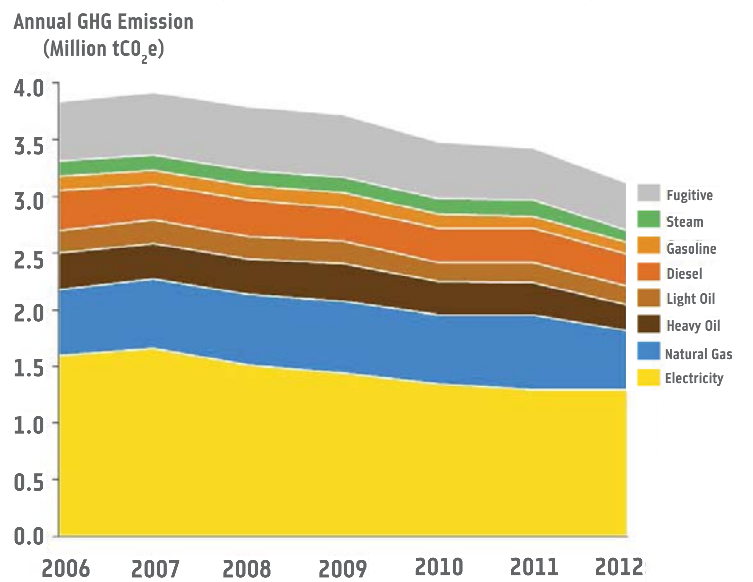
As shown in Figure 19, 92 percent of FY 2012 City government GHG emissions resulted from the operation of municipal buildings, wastewater treatment facilities, and the municipal vehicle fleet. Figure 20 also shows sources of GHG emissions, highlighting that fthe four largest fuel sources—the use of electricity and natural gas, diesel fuel, and the generation of methane—accounted for 78 percent of total City government GHG emissions.

Fig. 19: 2006 to 2012 City Government Annual GHG Emissions by Sector



Source: NYC Mayor's Office

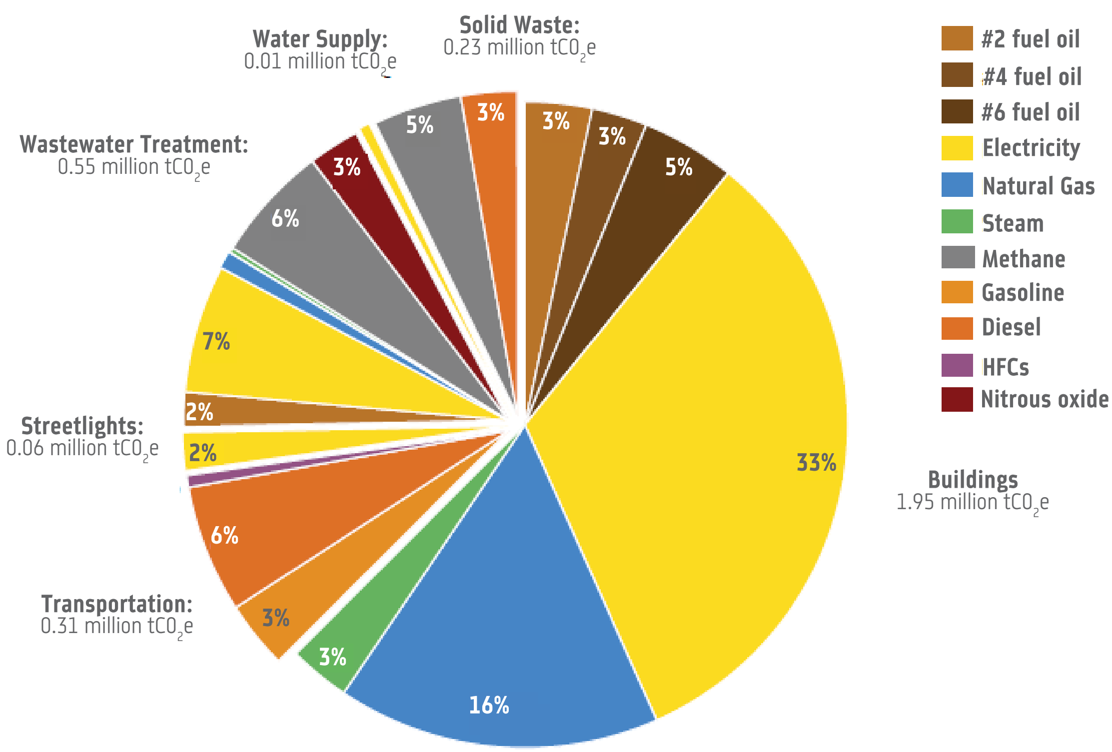
Fig. 20: 2006 to 2012 City Government Annual GHG Emissions by Source



Source: NYC Mayor's Office

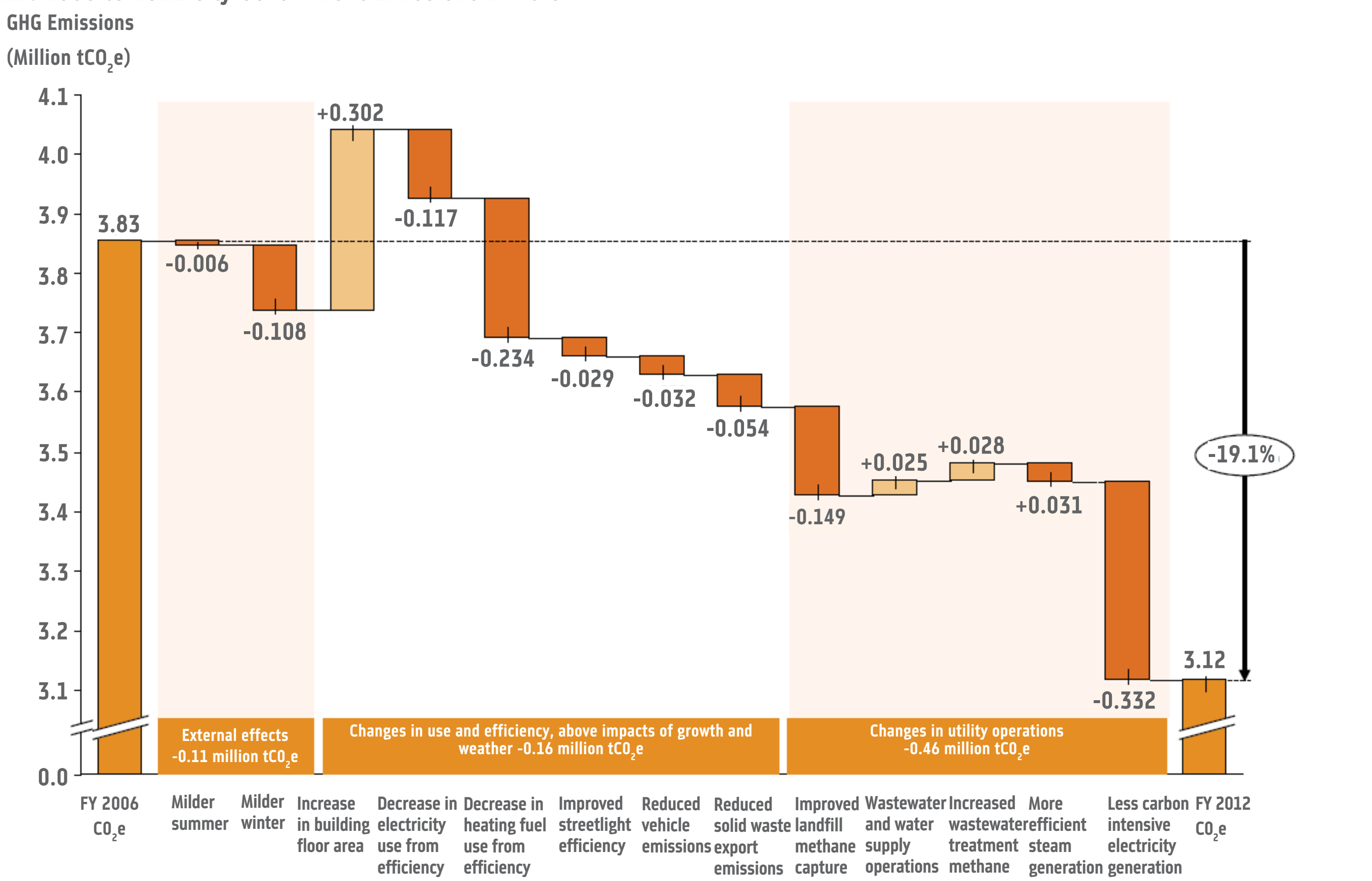
Fig. 21: 2012 City Government GHG Emissions by Sector and Source

From FY 2011 to FY 2012, a cleaner electricity supply drove the largest reduction in GHG emissions for city government.



Source: NYC Mayor's Office

Fig. 22: 2006 to 2012 City Government Emissions Drivers



Source: NYC Mayor's Office

In accordance with the LGOP, wastewater treatment and water supply GHG emissions are reported separately as sectors, as shown in Figure 19. Electricity use accounted for 37 percent of wastewater treatment and 83 percent of water supply GHG emissions. Fugitive CH_4 from wastewater treatment plants accounted for 32 percent of GHG emissions from this sector.

Changes to City government emissions

The City analyzed changes to emissions levels from FY 2006 to FY 2012 and from FY 2011 to FY 2012 to understand the reasons for changes beyond those driven by external factors such as weather, allowing for more targeted implementation of GHG mitigation policies. The below analysis reports on City government changes from all sectors—details of changes within each sector is reported in the sector specific sections of this chapter.

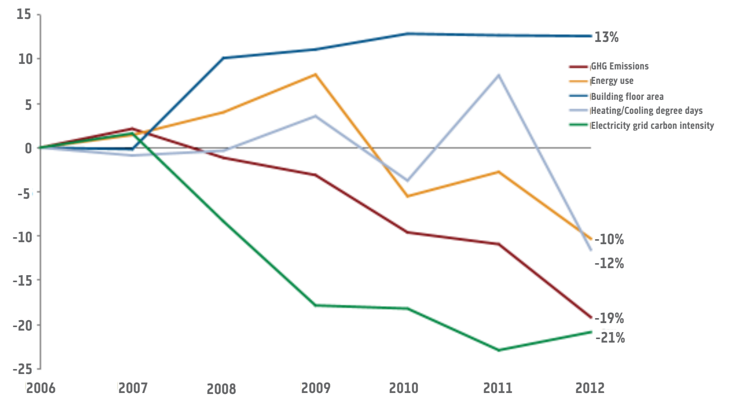
City government FY 2006 to FY 2012 changes

City government GHG emissions were 19.1 percent lower in FY 2012 than FY 2006, falling from 3.85 to 3.12 $MtCO_2e$. While the carbon intensity of the city's electricity supply increased slightly over the last year, it is still far below FY 2006 levels and is responsible for one of the largest decreases in GHG levels. Major reductions in municipal building energy use due to energy efficiency and clean distributed generation investments have yielded large GHG emissions reductions over this period—together, electricity and heating efficiency projects in City buildings account for the greatest GHG emissions reduction. Improved efficiency of streetlights and traffic signals, reduced fuel use in City fleet vehicles, decreased fugitive methane generation from City landfills, and improved efficiency in solid waste export transportation related to the City's Comprehensive Solid Waste Management Plan (SWMP) also contributed to this reduction. Increases in energy use in wastewater treatment and water supply operations from FY 2006 to FY 2008, along with increased fugitive methane emissions from WWTPs from FY 2006 to FY 2009 offset GHG emissions reductions somewhat. When the impact of weather, growth in City real estate, and changes to the carbon intensity of the city's electricity and steam supply are excluded, GHG emissions are shown to have decreased 16.4 percent from FY 2006 to FY 2012. Details of these reductions are presented in Figure 22.

City government FY 2011 to FY 2012 changes

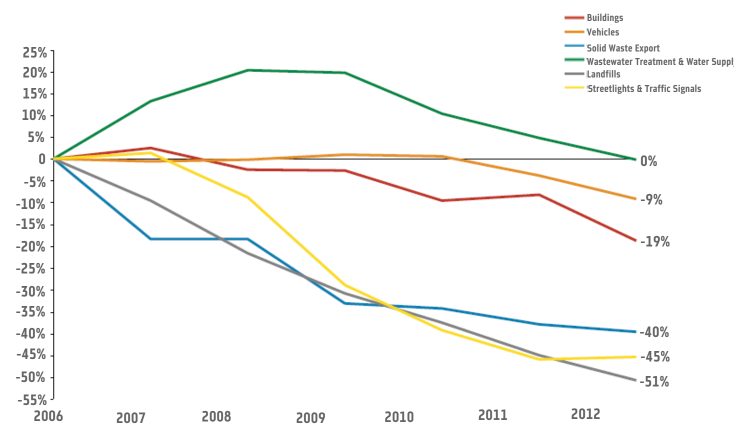
City government GHG emissions decreased by 9.3 percent from FY 2011 to FY 2012, from 3.43 to 3.12 $MtCO_2e$. Driving this reduction was electricity and heating fuel savings from energy efficiency and clean distributed generation investments in municipal buildings, increased methane capture at WWTPs, more efficient steam generation, reduced vehicle fleet fuel use, reduced landfill methane generation, reduced electricity and fuel use in WWTP and water supply operations, and improved efficiency in solid waste export. When

Fig. 23: Weather, Electricity Grid Carbon Intensity, and City Government Energy, GHG Emissions and Building Floor Area



Source: NYC Mayor's Office

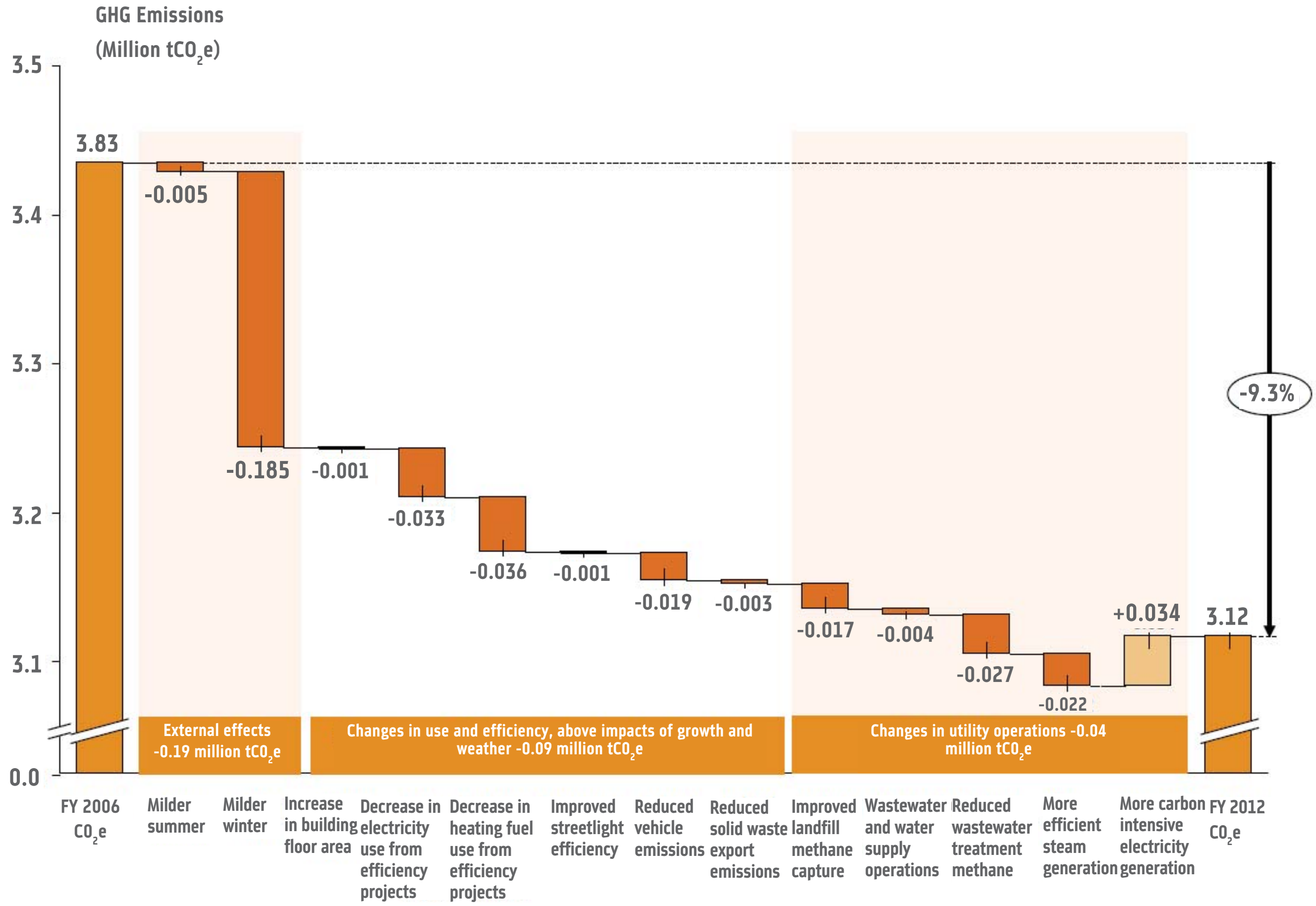
Fig. 24: 2006 to 2012 City Government Changes in GHG Emissions



Source: NYC Mayor's Office

holding factors such as the impact of weather, growth in City real estate, and changes to the carbon intensity of the city's electricity and steam supply constant, GHG emissions decreased 4.0 percent over this period. Figure 23 illustrates details of these changes.

Fig. 23: 2011 to 2012 City Government Emissions Drivers



Source: NYC Mayor's Office

GHG Mitigation Plan - "30 by 17"

In Fiscal Year (FY) 2006, the operation of New York City's government resulted in the emission of 3.9 million tCO_2e, and the City's government used approximately 6.5 percent of New York City's overall energy. In July 2008, the City released its Long-Term Plan to Reduce Energy Consumption and Greenhouse Gas Emissions of Municipal Buildings and Operations (Long-Term Plan). This plan was a road map for achieving the goal first outlined in PlaNYC in April 2007—to reduce emissions from City government 30 percent from FY 2006 levels by 2017—then further codified through executive order 109 of 2007 and local law 22 of 2008. The local law and the executive order also established a funding stream for energy efficiency and GHG reduction initiatives, committing 10 percent of the City's annual energy budget for these measures (approximately $800 million in 2008, resulting in $80 million in energy efficiency investments), and established a governance structure for the City's efforts.

The Long-Term Plan enumerated the scale of the 30 percent reduction, outlined a strategy for reaching that goal, and estimated the cost of the strategy at $2.3 billion. The strategy focused on buildings, the City's largest source of emissions, with plans for large-scale retrofits and the introduction of an Operations and Maintenance program for City buildings. Together, these programs comprised 57 percent of the overall strategy's GHG reductions. In addition, the City's strategy included plans to improve efficiency at some of the City's 14 in-city wastewater treatment plants through retrofits and methane emissions capture, efficiency upgrades for street lighting, and plans to increase the efficiency of the City's fleet through right sizing, adopting proven vehicle technology, and continue to pilot new technologies.

The benefits of the City's strategy would be two-fold: the early reductions would support the Citywide strategy to reduce GHG emissions 30 percent by 2030, and as first movers in adopting new technologies for energy efficiency, the City would lead by example, creating case studies for the private sector to follow in its own efficiency efforts.

30 X 17 Progress to Date

New York City's FY 2012 GHG emissions were 19 percent below FY 2006 levels – almost two-thirds of the way to the City's goal in only half the time. In just the last year GHG emissions were down 9 percent – demonstrating the impact of the City's carbon mitigation investments.

The City has had many successes in implementing the strategy outlined in the Long-Term Plan, reducing energy in its buildings, streetlights and traffic signals, water supply and wastewater treatment system, vehicle fleet, and solid waste management system. Perhaps the most telling evidence of this program's success is the progress made in just the last year, as GHG emissions directly related to the City's actions were 4.0 percent lower in just one year—a reduction of approximately 0.14 MtCO_2e—demonstrating substantial returns on investments that have been made over the last five years.

City Government GHG Emissions by Sector

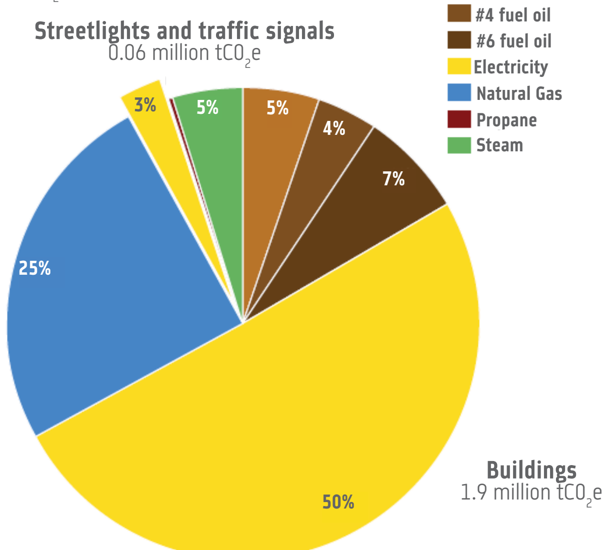
Buildings and Streetlights

Much of the City's success in the first five years has resulted from the City's building retrofit program. The City operates more than 4,000 buildings, including schools, police precincts, park restrooms, courthouses and many others, to provide basic government services to New Yorkers. To address building efficiency upgrades more comprehensively the City has transitioned from a program of single measure lighting and Heating Ventilation Air Conditioning (HVAC) projects, to a more systematic, data driven approach, following the City's Greener, Greater Buildings Plan (GGBP).

The City annually benchmarks more than 3,000 of its buildings (those with a floor area greater than 10,000 square feet) for energy performance. Using the benchmarking results, the City prioritizes those buildings with the greatest potential for efficiency improvements for energy audits and retro-commissioning studies. Based on the results of these reports, the City implements projects designed to replace more than just the lights; potential upgrades also include high efficiency motors and the use of variable speed drives, installing and upgrading computerized Energy Management Systems, building envelope improvements, upgrading compressed air systems, and installing high efficiency boilers, chillers, and improving ventilation systems and controls.

Fig. 24: City Government Buildings & Streetlights GHG Emissions by Source

2.01 million tCO_2e



Kerosene is less than 0.01% of buildings sector total

Source: NYC Mayor's Office

To date, the City has completed 265 energy audits and 224 retro-commissioning studies on its largest buildings. Based on the results of these audits, the City has designed and implemented over 175 retrofit projects, reducing annual GHG emissions by more than 31,500 tCO_2e, with annual energy cost savings of more than $10.5 million. An additional 130 retrofit projects are underway, including some upgrades to some of the largest, most complicated buildings the City operates, with estimated annual savings of over 100,000 tCO_2e and more than $32 million.

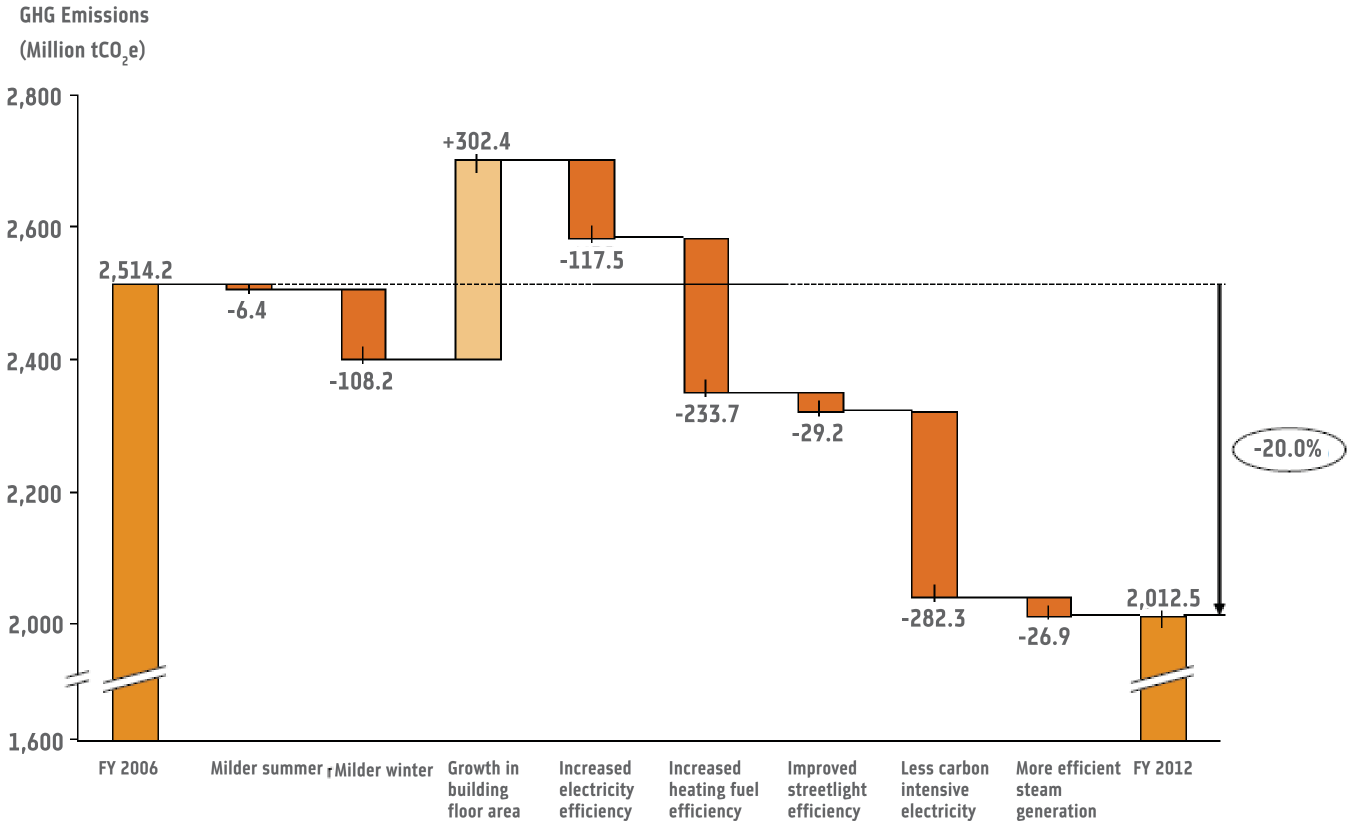
The City is also addressing building efficiency through improving efficiency in day-to-day operations and maintenance. The largest energy-consuming agencies now have energy managers who are responsible for implementation of retro-commissioning measures, as well as ensuring that buildings are operated as efficiently as possible. In addition, the City is training its building operators in efficient operations, with over 1,300 building operators trained, and many of them receiving energy manager and building operator certifications.

Investments in cogeneration and renewable generation have also helped support the City's GHG emissions mitigation strategy. In 2012, the City completed 10 solar photovoltaic (PV) installations across the five boroughs, tripling the City's installed solar capacity to 0.7 MW. Cogeneration projects, including a microturbine at the Bronx Zoo, have added another 4.8 MW of generating capacity. In addition, the DEP is designing a new 12 MW cogeneration facility at the North River Wastewater Treatment plant and will begin construction in 2015. This will bring DEP's total cogeneration capacity to 23 MW.

The City has upgraded nearly 250,000 streetlights to fixtures that maintain equal lighting levels but use one-third less wattage, saving more than 35,000 tCO2e annually. While this program will account for about 3 percent of the overall total GHG savings contributing to the 30 x 17 goal, it represents an early success the City can build on as the results of the programs with longer lead times come to fruition.

Further, with this original retrofit program all but complete, the New York City Department of Transportation (DOT) is embarking on plans to improve the efficiency of streetlights further by upgrading to light emitting diode (LED) technology. To date, DOT has upgraded 3,425 streetlights with LED fixtures, and plans to upgrade all 250,000 standard streetlights with LEDs by 2017.

Fig. 25: 2006 to 2012 Changes to City Government Buildings and Streetlights GHG Emissions



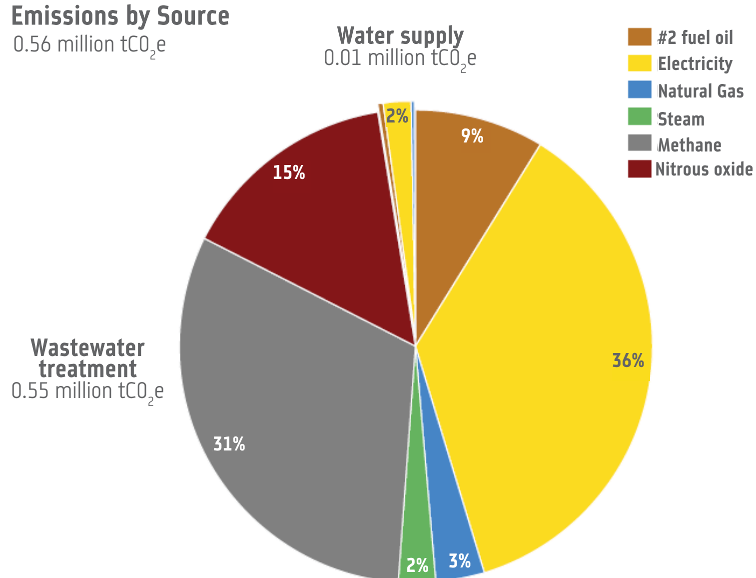
Source: NYC Mayor's Office

Water Supply and Wastewater Treatment

The New York City Department of Environmental Protection (DEP) is responsible for protecting public health and the environment by supplying clean drinking water, collecting and treating wastewater, and reducing air, noise, and hazardous substances pollution. The city's water supply system extends more than 125 miles from New York and is comprised of 19 reservoirs, 3 controlled lakes, over 7,000 miles each of water mains and sewers, and 14 wastewater treatment plants (WWTP). Approximately one billion gallons of water is supplied each day almost entirely by gravity to residents of New York City and the surrounding counties of Orange, Ulster, Westchester, and Putnam, while approximately 1.3 billion gallons of wastewater is collected and treated each day.

While the majority of this system is designed to operate by gravity, it still requires a large amount of energy to operate—more than seven million MMBtu per year. As such, GHG emissions from water supply and wastewater treatment accounted for 18 percent of total City government GHG emissions in FY 2012. The wastewater treatment process alone accounted for 97 percent of the City's

Fig. 26: City Government Water Supply and Wastewater Treatment GHG Emissions by Source



Source: NYC Mayor's Office

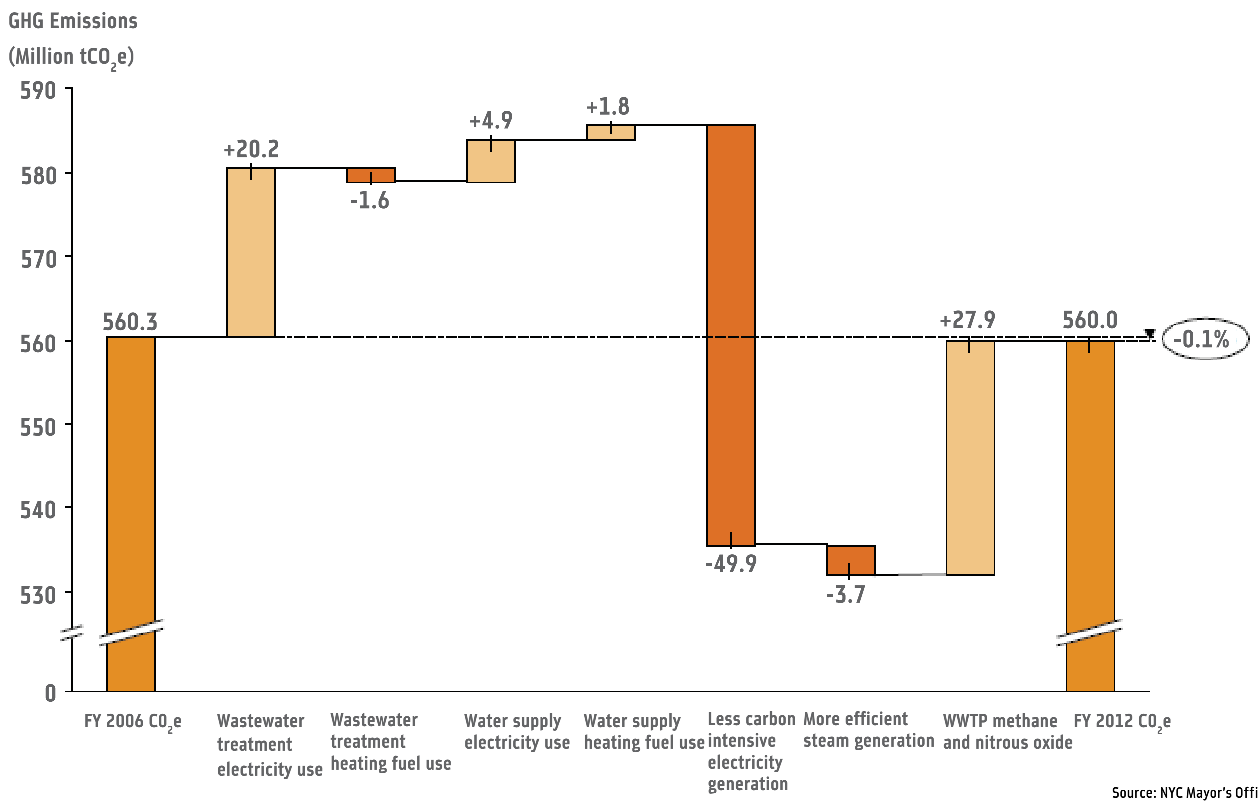
water supply and wastewater treatment GHG emissions. Federal and state mandates to meet new air and water quality standards, such as requiring the construction and activation of new facilities or changes to water and wastewater treatment protocols, has led to a 16 percent increase in DEP's energy use between FY 2006 and FY 2012. Despite the mandated additions, energy conservation measures implemented by DEP have resulted in a 39 percent decrease in electricity use from a business as usual scenario. Over the next five years, it is expected that these mandates will increase DEP's annual electric use by 58 percent (resulting in the emission of 80,000 tCO_2e). As a result, the agency is looking beyond the 2017 goal toward achieving energy neutral operations. Measures to reduce GHG emissions include energy efficiency, conservation and generation initiatives, the elimination of fugitive methane emissions, the integration of clean, renewable energy supplies, and alternative, less energy-intensive biological processes for treating wastewater.

To reduce energy use and increase energy efficiency, DEP has completed energy audits at all 14 in-city WWTPs. Almost 200 energy conservation measures (ECMs) relating to operational and equipment improvements to aeration, boilers, dewatering, digesters, HVAC, electrical, thickening, and main sewage pumping systems have been identified, with the potential to reduce greenhouse gas emissions by over 200,000 tCO_2e per year. DEP is evaluating the implementation method and schedule for the ECMs over the next four years and beyond.

Fugitive methane emissions from wastewater treatment plants currently account for 32 percent of GHG emissions from the wastewater treatment sector. Recent investments to repair leaks and upgrade emissions control equipment have already resulted in a 30 percent reduction of methane emissions since a peak in 2009, and the City has allocated an additional $500 million for 2013 to 2020 to make additional system repairs to flares, digesters domes, and digester gas piping, as well as upgrades to emission controls.

To reduce GHG emissions further, DEP has prioritized increasing the beneficial use of anaerobic digester gas (ADG) as a fuel source. In FY 2012, DEP's wastewater treatment plants beneficially used approximately 38 percent of the ADG produced, primarily in boilers to generate heat for digesters and buildings. Two WWTPs also use the ADG as a fuel in engines that power generators to produce electricity and heat to meet approximately one-third of the plants' electricity demand and most of their thermal demands. DEP has set a target of 60 percent beneficial use of ADG produced and has

Fig. 27: 2006 to 2012 Changes to City Government Wastewater and Water Supply Emissions



Source: NYC Mayor's Office

several projects planned to achieve this target by 2020, including a gas-to-grid project that will deliver excess digester gas from the Newtown Creek WWTP to the local natural gas distribution system. This project is expected to reduce GHG emissions by approximately 16,500 tCO_2e per year from reduced methane flaring and offsetting grid natural gas use.

The North River WWTP is in the process of replacing direct-drive engines with new, efficient motors and a cogeneration system that will generate 12 MW of electricity to meet the plant's base electricity demand. The new system will also recover enough heat for the plant's process and building heating needs. This project will offset the use of 90 percent of utility electricity and over 1.7 million gallons of fuel oil, and will almost double the use of ADG on-site, resulting in emissions reduction of approximately 10,000 tCO_2e per

Vehicle Fleet

New York City operates the largest municipal vehicle fleet in the U.S. with nearly 26,000 vehicles. New York City has also implemented the most aggressive vehicle fleet sustainability program in the country, investing more than $400 million to reduce its fleet fuel use and GHG emissions in the last 12 years, leading to a total GHG reduction of more than 9 percent since FY 2006. Driving these reductions is a 19,000 tCO_2e reduction from gasoline vehicles and an 8,000 tCO_2e reduction from diesel vehicles. In the last two years alone, New York City reduced its vehicle fuel use by 2 million gallons, a 4 percent reduction.

Since 2009, the City has reduced the light-duty vehicle fleet size by over 1,000 units. New York City is also implementing the largest fleet share pilot program in the United States. Currently, 580 City vehicles use Zipcar's Fast Fleet car share and pooling technology, allowing employees to reserve pool vehicles online.

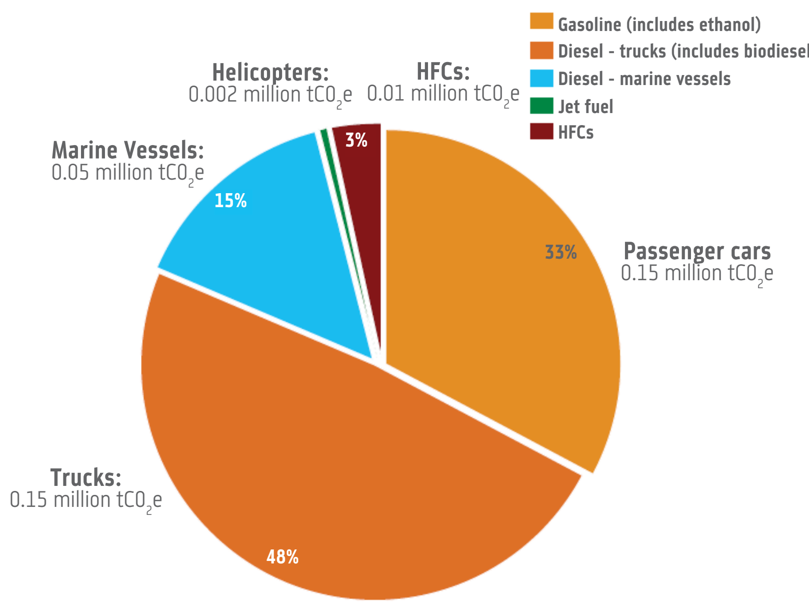
New York City's fleet has more than 6,000 hybrid-electric and plug-in electric vehicles (EVs) in operation, with resulting fuel economy improvements leading to reduced fuel use, costs, and GHG emissions. The City also operates 100 Chevy Volts and recently procured 60 new Ford Focus and Nissan Leaf EVs. The City now has long-term requirement contracts for all three types of plug in EVs, allowing them to be standard vehicles for new purchases for years to come. The City also operates 136 compressed natural gas vehicles and is planning to expand the size of this fleet by over 50 percent in the next year.

The City's biodiesel mandate requires that all diesel vehicles, 9,777 in total, use at least B5 grade biodiesel or better. Vehicles from the Departments of Parks and Recreations, Sanitation, and Environmental Protection use B20 during warm weather months, and the City will soon begin to pilot the use of B20 during the winter with at least 5 percent of its fleet. In addition to hybrid-electric passenger vehicles, the City is one of the nation's largest implementers of diesel hybrid-electric technology.

While the City's fleet reduction and fuel efficiency measures have already yielded impressive GHG emissions reductions, more measures are underway. The City is currently rolling out a program of automated fuel and fleet tracking for all City-owned fuel sites, greatly improving its ability to manage, analyze, and optimize the nearly $100 million in annual fuel expenditures. The City has also implemented a Clean Fleet Transition Plan (CFTP), requiring all new vehicle purchases to achieve improved fuel economy and emissions than the vehicles they replace.

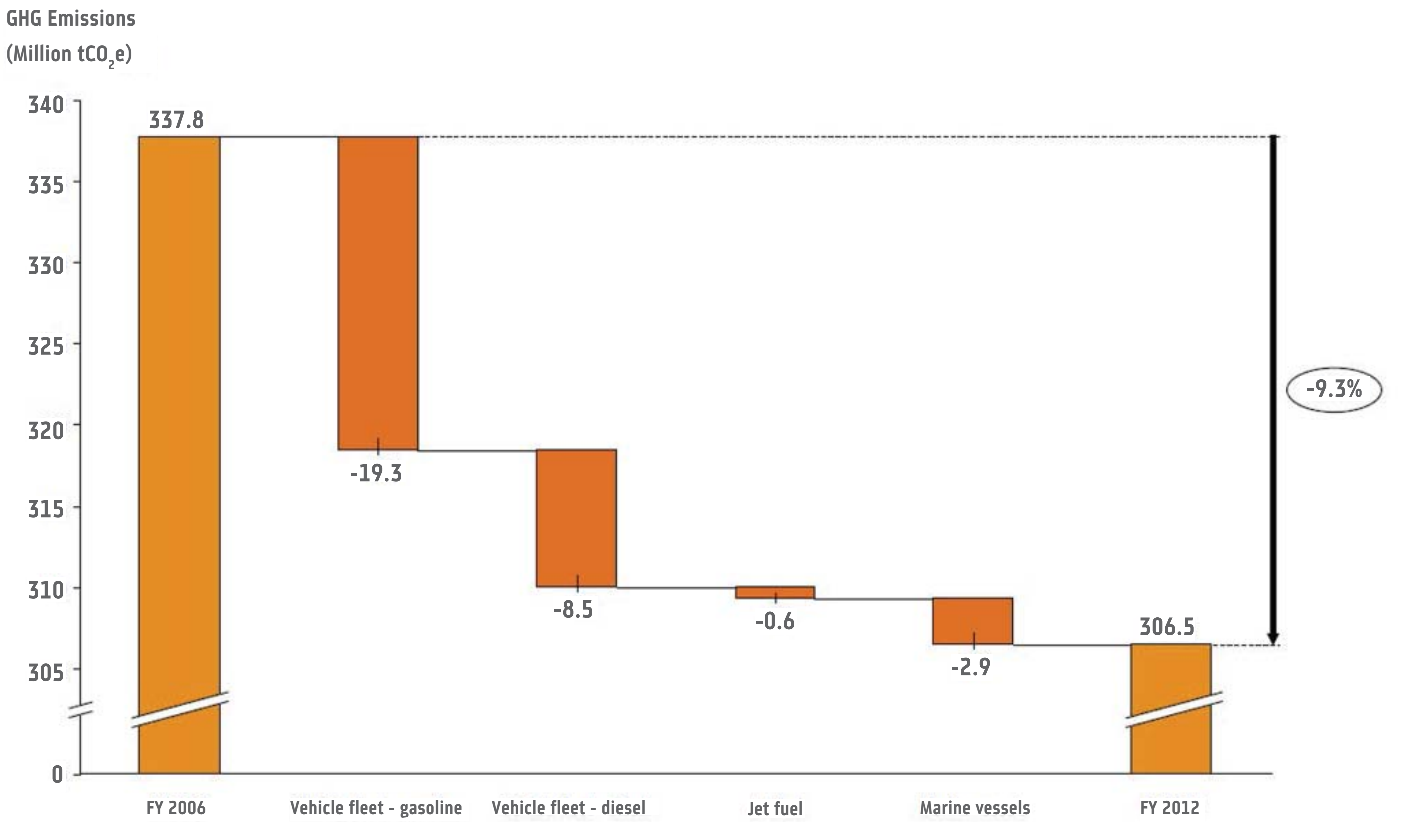
Fig. 28: City Government Vehicle Fleet GHG Emissions by Source

0.32 million tCO_2e



Source: NYC Mayor's Office

Fig. 29: 2006 to 2012 Changes to City Government Vehicle Fleet GHG Emissions



Source: NYC Mayor's Office

Solid Waste

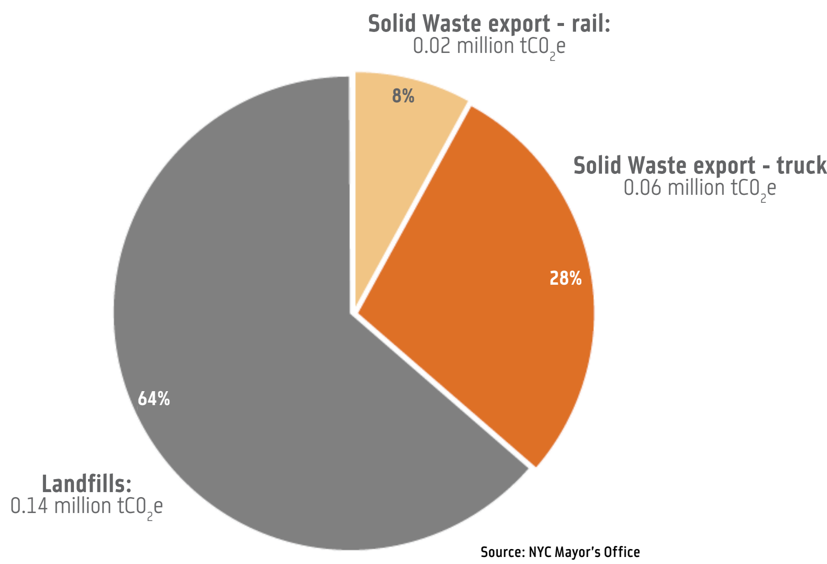
The New York City Department of Sanitation (DSNY) collects and manages more than 10,000 metric tons of solid waste per day, transporting it to waste to energy facilities and landfills located outside the city. DSNY also manages Freshkills and Edgemere landfills, while DEP manages Pelham Bay, Fountain Avenue, Pennsylvania, and Brookfield Avenue landfills—all of which are closed and no longer accepting solid waste.

Because the City-operated landfills are closed, their generation of methane is steadily declining as their waste decomposes. DEP is in the process of installing a methane control system on Brookfield Avenue landfill, which will reduce this facility's fugitive release of methane significantly.

In 2006, the City released its Comprehensive Solid Waste Management Plan (SWMP), which requires the City to switch from a truck-based system for exporting solid waste to one that uses a combination of marine barges and freight rail. Because rail is far more efficient than trucks per ton-mile, this plan has already reduced annual GHG emissions from solid waste export by more than 54,000 tCO_2e.

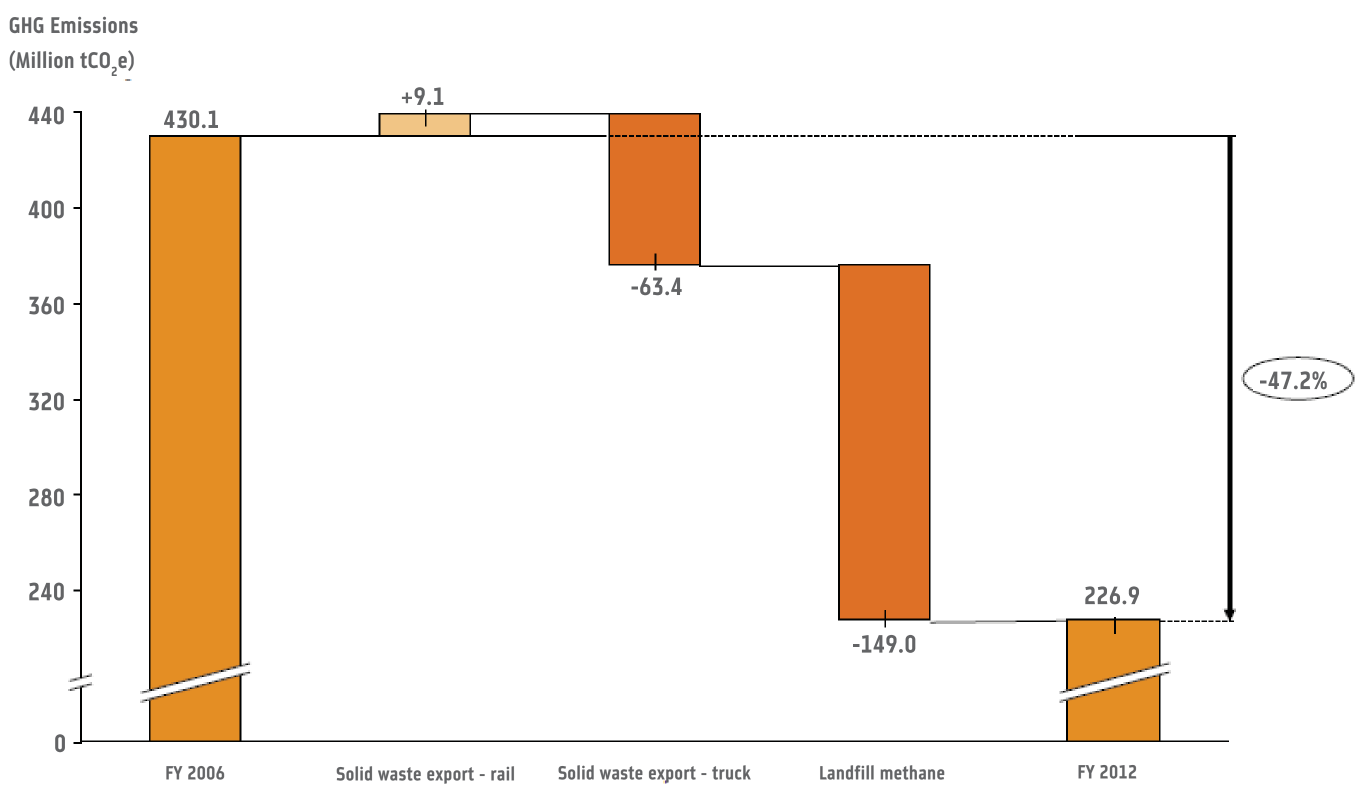
Fig. 30: City Government Solid Waste GHG Emissions by Source

0.22 million tCO_2e



Source: NYC Mayor's Office

Fig. 31: 2006 to 2012 Changes to City Government Solid Waste GHG Emissions



Source: NYC Mayor's Office

Next Four Years of "30 x 17"

While the City has achieved success in meeting its GHG mitigation target—especially over the last year—much more needs to be done to ensure successful achievement of the 30 percent GHG reduction by 2017. Continued implementation of current initiatives (including retrofits and audits and retrocommissioning for buildings, vehicle fleet fuel reduction, and WWTP methane control) must be augmented by new and innovative measures to ensure the GHG goal is achieved.

To reduce electric load on peak days, the City has a new program to increase its City operations' Demand Response commitment. The current program reduces 20 MW of electricity load on peak days with a goal to increase the commitment to 50 MW within five years. These actions will help ensure the reliability of the City's grid on the hottest days.

Yet again in 2013, the City is on track to triple its PV generation capacity, having executed a new solar Power Purchase Agreement ("PPA") for roughly 2 MW across four facilities including two schools, a wastewater treatment plant, and a ferry maintenance facility. Solar-ready buildings across the City's portfolio are potential candidates to adopt this model of delivering lower-cost PV generation.

Since PlaNYC's launch in 2007, the City has completed 175 building retrofits, and it is expanding both its retrofit and audit and retrocommissioning program to improve the City's energy management and building performance further. While comprehensive retrofits are a significant contributor to GHG emissions reduction, the City has learned that the comprehensive approach may not be appropriate for all facilities, as it may overlook more cost-effective potential projects, delaying GHG emissions reductions and energy costs savings. Consequently, in 2013, the New York City Department of Citywide Administrative Services (DCAS) Division of Energy Management launched the Accelerated Conservation and Efficiency program or "ACE"—allocating $100 million for the first phase of quick energy efficiency and clean heat retrofits that will be implemented by City agencies in late 2013. The ACE Program overall is expected to reduce City government GHG emissions by 5 percent below FY 2006 levels.

With a vast portfolio of real estate, large and diverse vehicle fleet, expansive water supply and wastewater treatment system, and other assets, the City has additional opportunities to demonstrate the value of new and emerging carbon mitigation technologies through pilot demonstrations. Using the City's own assets as a "Living Laboratory" will provide support for the development of new energy efficient technology, while allowing the City to demonstrate to other cities and the private sector the advantages of new carbon mitigation measures while continuing to contribute to the citywide carbon reduction goal.

The City continues to increase its efforts to increase its climate resiliency, including improving grid reliability and protecting critical infrastructure from coastal storm effects. The City is helping to increase the resiliency and reliability of the City's electricity grid by implementing more clean and renewable distributed generation installations at its facilities and participating in an advanced microgrid demonstration project. Moving forward, the City will continue to look for opportunities to support resiliency and reliability as part of its larger effort to reduce greenhouse gas emissions, energy use, and energy costs.

"30 x 17" by the Numbers

3,097 buildings over 10,000 square feet benchmarked

265 energy audits completed, 50 underway

224 retro-commissioning reports completed, 50 underway

175 building retrofits completed, 130 underway

0.67 MW of renewable generation installed, 1.85 MW additional underway

4.8 MW of cogeneration capacity installed, 25 MW additional underway

1,381 City employees trained in efficient building operations

50,000 tCO_2e of fugitive methane emissions leaks repaired

38% of anaerobic digester gas from WWTP being beneficially reused

618 Electric vehicles and plug-in hybrids currently in the City fleet

5,385 hybrid vehicles in the City fleet

NYC's first commercial net-metered solar electric generating system in Brooklyn

Source: NYC DCAS

APPENDICES

Appendix A

Citywide Inventory Methodology

ConEdison (ConEd) provided data on use of citywide electricity and steam, and natural gas in the Bronx, Manhattan, and parts of Queens. National Grid reported natural gas use data for Brooklyn, parts of Queens, and Staten Island. The Long Island Power Authority (LIPA) reported electricity use data for the Rockaways area of Queens. Fuel oil use was provided by private fuel oil suppliers, per Local Law 43 of 2013, which requires fuel oil providers to report fuel oil deliveries by fuel type to the City on an annual basis. The New York Metropolitan Transportation Council (NYMTC) provided on-road transportation vehicle-miles-traveled (VMT) data. Energy use data for public transit were provided by the Metropolitan Transportation Authority (MTA) for New York City Transit (NYCT) subways and buses, Staten Island Railway (SIR), MTA Metro-North Rail Road (MNR) and Long Island Railroad (LIRR) commuter rail, and MTA Bus Company buses; by the Port Authority of New York and New Jersey (PANYNJ) for Trans-Hudson (PATH) commuter rail; and New Jersey Transit (NJT) for its commuter rail and buses.

Data used to calculate fugitive and process CH_4 and process N_2O from wastewater treatment were provided by DEP. CH_4 emissions were calculated based on the destruction of volatile material in anaerobic digesters. Based on the measured concentration and flow of volatile organic solids, it is estimated that 15 cubic feet of digester gas is produced for every pound of volatile organic solids destroyed. N_2O emissions were calculated by applying the daily nitrogen load discharged by each of the City's 14 wastewater treatment plant to the formula in the LGOP.

Fugitive CH_4 from in-city landfills was calculated from landfill gas collection data provided by the New York City Department of Sanitation (DSNY) and DEP per the LGOP. Fugitive CH_4 from exported solid waste was calculated using waste disposal figures for residential, commercial, and construction and demolition waste and applying emissions factors from the USCP, which were taken from EPA's Waste Reduction Model (WARM). Fugitive CH_4 from natural gas distribution was calculated using data provided by National Grid and ConEd. Fugitive SF_6 from electricity distribution was calculated using data provided by ConEd.

All DSNY-managed municipal solid waste (residential and some institutional solid waste) generated in New York City is exported to landfills by private contractor and waste-to-energy facilities by DSNY. Fuel consumed by trains and trucks exporting solid waste out of the city is calculated using data provided by DSNY detailing the mass of waste transported, mode of transport, and distance to each disposal facility. Fuel use was calculated by estimating how many trucks and trains are needed to transport the waste, and applying average fuel economy figures to the weighted average distance to receiving landfills.

Scope 3 aviation emissions were calculated using fuel use data from the PANYNJ. Emissions coefficients in the LGOP were applied to the total volume of jet fuel and aviation gasoline loaded onto airplanes at LaGuardia and John F. Kennedy airports, as modeled by PANYNJ using the numbers of passengers departing from each airport during the year of analysis.

GHG emissions were calculated from all data acquired as described using emissions coefficients in the LGOP, unless otherwise noted. Fuel economy factors for on-road vehicles were calculated as described in the Updates and Revisions section of the Appendices. All emissions coefficients and fuel economy figures are reported in Appendix C.

Appendix B

City Government Inventory Methodology

All data used to complete the 2012 City government GHG inventory were acquired from City agencies or fuel vendors. Electricity, natural gas, and steam usage for the City's buildings, facilities, and streetlights was provided by DCAS. Fuel vendors and DEP supplied heating and vehicle fuel usage. Calculation of GHG emissions from fuel uses the volume of fuel delivered as an estimate of the volume of fuel used.

Fugitive and process emissions were calculated using data provided by several agencies: DEP for CH_4 and N_2O emissions from wastewater treatment; DEP and DSNY for fugitive CH_4 from landfills; DCAS for HFCs from municipal vehicle fleet cooling and refrigeration systems; and DSNY for emissions from the long-haul export of solid waste. All calculations were made as described in the citywide inventory methodology section.

The City government inventory also reports emissions associated with employee commuting as a Scope 3 information source. These were estimated using the U.S. Census Bureau's Public-Use Microdata Sample dataset, which reports the means of transportation to work for City employees. The methodology used for the 2012 Inventory is the same as that outlined in past New York City inventories.

Emissions from the decomposition of solid waste generated by City employees are also considered a Scope 3 information source. These emissions were calculated by multiplying the number of employees by the estimated annual volume of solid waste generated by each employee, as calculated by DSNY.

Appendix C

Emissions Coefficients Methodologies

Electricity emissions coefficient

The City has developed its own electricity emissions coefficient, rather than using the U.S. Environmental Protection Agency's (EPA) eGRID coefficient. The City does this for several reasons:

- The eGRID coefficient is regionally based on all Westchester County and New York City electricity generation,
- The eGRID coefficient does not include electricity that is imported into New York City from New Jersey or New York beyond Westchester County, which is a significant amount of the electricity supply,
- The eGRID coefficient is based on data that are several years old—the most recent eGRID coefficient is based on 2009 generation data—this does not allow the City to measure the impact of changes to the power supply that occurred during the year of analysis.

The City used power plant data from EPA's Continuous Emissions Monitoring System (CEMS) database and the U.S. Energy Information Administration's (EIA) EIA-923 database (previously titled EIA-906) to calculate the CO_2e emissions coefficient from electricity. Data from these sources were acquired from a data warehouse (Ventyx, Velocity Suite) and were organized to develop specific emissions coefficients for each plant in the New York Independent System Operator's (NYISO) and Public Service Electric and Gas (PSEG) territories. From these data, New York City's electricity emissions coefficient was calculated by taking the following steps:

1. All electricity generated within New York City (NYISO Zone J), all electricity imported to New York City through bilateral contracts between power generators and the New York Power Authority (NYPA) and Consolidated Edison of New York (ConEd), and measured electricity flows from New Jersey's PSEG territory over the Linden-VFT transmission line (PJM) were added to determine the known quantity of use from these sources.
2. Additional imported electricity volume was calculated by subtracting the combined in-city generation, bilateral contracts, and PJM imports from New York City's required energy, as listed in NYISO's 2013 Load & Capacity Data "Gold Book".
3. Emissions coefficients for both in-city and imported generation were calculated for CO_2, CH_4, N_2O, and CO_2e based on each plant's heat rate (efficiency) and primary fuel used for generation.
4. Energy use attributed to steam generation at in-city cogeneration plants was deducted from the energy input used to calculate each plant's emissions coefficient, using ConEd's steam system data, to avoid double counting emissions resulting from this generation.
5. Due to existing transmission constraints, the emissions coefficient for imported power was assumed to be generated in the downstate region (NYISO Zones G, H, and I), with the balance of the energy requirement imported from the rest of New York State (NYISO Zones A-F, and K).
6. A transmission and distribution loss factor, calculated by subtracting ConEd's and the Long Island Power Authority's (LIPA) reported electricity deliveries from the NYISO energy requirement was applied to derive the City's electricity emissions coefficient. This coefficient is presented in detail in Appendix C.

The City encourages all entities in New York City, public and private, to use this coefficient to complete GHG inventories. Revised electricity emissions coefficients were applied to past years' inventory results.

Steam emissions coefficient

The City developed its own steam emissions coefficient in cooperation with ConEd, as in past inventories. The revised steam coefficient is applied to community and City government 2012 inventories. The steam emissions coefficient is presented in detail in Appendix H.

The steam emissions coefficient used by New York City is developed in cooperation with ConEd and takes into account the impact of generating steam by means of co-generation. This coefficient is intended to be used for macro, city-scale analyses, as the accounting methodology used by ConEd (as recommended by the EPA and approved by the New York State Public Service Commission (PSC)) allocates the majority of fuel used for cogenerated steam to electricity generation, which is accounted for in the City's electricity coefficient. As such, applying this steam coefficient to more granular, project-specific analyses may not yield appropriate results.

Exported solid waste

The emissions factors used to calculate emissions from solid waste exported out of New York City to landfills and waste to energy facilities were revised, replacing those used in the 2012 Inventory and applied to previous years' GHG emissions results. These updated factors from the EPA's Waste Reduction Model (WARM) are included in the final version of the USCP.

Appendix D

City Government Calendar Year Results

City government CY 2008 to CY 2012 Changes

New York City's government GHG emissions were in 3.08 million tCO_2e CY 2012, resulting in an 8.0 percent decrease from calendar year 2011 and a 21.5 percent decrease from CY 2008 base year GHG emissions, when calendar year emissions were first reported. CY 2012 GHG emissions are broken down as follows:

- Scope 1 GHG emissions: 1,694,145 tCO_2e
- Scope 2 emission: 1,390,752 tCO_2e
- 3 GHG emissions: 362,909 tCO_2e
- Additional emissions reported as information items only, not counted toward the City's total emissions results (e.g. biogenic emissions from combustion of biofuel): 19,813 tCO_2e

City government CY 2008 to CY 2012 Changes

From CY 2008 to CY 2012, municipal GHG emissions decreased 21.5 percent, from 3.93 to 3.08 tCO_2e. In addition to a milder winter, the main factors of this change were a reductions in per building area electricity and heating fuel use, reduction in the carbon intensity of the city's electricity supply, increased CH_4 capture at wastewater treatment plants, reduced energy use in wastewater and water supply operations, reduced vehicle emissions, more efficient streetlights and traffic signals, and improved efficiency in solid waste export transportation from truck to rail as part of the City's Comprehensive Solid Waste Management Plan. When external factors of weather, growth in City real estate, and the carbon intensity of the city's electricity and steam supply are excluded, GHG emissions are shown to have decreased by 19.1 percent over this period.

City government CY 2011 to CY 2012 Changes

From CY 2011 to CY 2012, City government GHG emissions decreased 8.0 percent, from 3.35 to 3.08 tCO_2e. In addition to a milder winter and summer, the main factors of this change were a reductions in per building area electricity and heating fuel use, reduced landfill CH_4, reduced energy use in wastewater and water supply operations, improved WWTP CH_4 capture, and improved efficiency in solid waste export transportation from truck to rail as part of the City's Comprehensive Solid Waste Management Plan. When external factors of weather, growth in City real estate, and the carbon intensity of the city's electricity and steam supply are excluded, GHG emissions are shown to have decreased by 6.4 percent over this period.

Appendix E

Acronym Definitions

NYC agencies

DCAS – New York City Department of Citywide Administrative Services

DEP – New York City Department of Environmental Protection

DSNY – New York City Department of Sanitation

Other entities

C40 – C40 Cities Climate Leadership Group

CARB – California Air Resources Board

CCAR – California Climate Action Registry

ConEd – Consolidated Edison of New York

EIA – United States Energy Information Administration

EPA – United States Environmental Protection Agency

ICLEI – ICLEI-Local Governments for Sustainability

LIPA – Long Island Power Authority

LIRR – Long Island Railroad

MTA – Metropolitan Transportation Authority

MNR – Metro North Rail Road

NJT – New Jersey Transit

NYCT – New York City Transit

NYISO – New York Independent System Operator

NYMTC – New York Metropolitan Transportation Council

NYPA – New York Power Authority

NYSERDA – New York State Energy Research and Development Authority

PANYNJ – Port Authority of New York and New Jersey

PATH – Port Authority Trans-Hudson Corporation

PSC – New York State Public Service Commission

PSEG – Public Service Enterprise Group

SIR – Staten Island Railway

TCR – The Climate Registry

WRI – World Resources Institute

Acronyms used throughout report

BAU – business as usual

Btu – British thermal units

CDD – cooling degree days

CEMS – Continuous Emissions Monitoring System

CH_4 – methane

CO_2 – carbon dioxide

CO_2e – carbon dioxide equivalent

CY – calendar year

eGRID – Emissions and Generation Resource Integrated Database

FY – fiscal year

GDP – gross domestic product

GHG – greenhouse gas

GJ – gigajoule

GWh – gigawatt hour

GPC – Global Protocol for Community-Scale Greenhouse Gas Emissions

HDD – heating degree days

HFCs – hydrofluorocarbons

kBtu – one thousand British thermal units

kg – kilogram

km – kilometer

LGOP – Local Government Operations Protocol

MMBtu – million British thermal units

MW – megawatt

N_2O – nitrous oxide

PPA – power purchase agreement

ROS – rest of state

SF_6 – sulfur hexafluoride

SWMP – Solid Waste Management Plan

tCO_2e – metric ton of carbon dioxide equivalent

T&D – transmission and distribution

USCP – United States Community Protocol for Accounting and Reporting Greenhouse Gas Emissions

VFT – variable frequency transformer

VMT – vehicle miles traveled

WARM – Waste Reduction Model

Appendix F

Endnotes

1. City of New York, *Long Term Plan to Reduce Energy Use and Greenhouse Gas Emissions of Municipal Buildings and Operations*, available online at http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/ecse_long_term_plan.pdf.

2. City of New York, *Inventory of New York City Greenhouse Gas Emissions* (April 2007), available online at http://www.nyc.gov/html/om/pdf/ccp_report041007.pdf. The City is amending the convention to which these documents refer to avoid confusion. All past inventory documents will now be referred to by the year of citywide emissions analysis—e.g. the inventory released in April 2007 reporting citywide 2005 emissions will be the 2005 Inventory.

3. City of New York, *Inventory of New York City Greenhouse Gas Emissions* (September 2008), available online at http://www.nyc.gov/html/planyc2030/downloads/pdf/inventory_nyc_ghg_emissions_2008_-_feb09update_web.pdf.

4. City of New York, *Inventory of New York City Greenhouse Gas Emissions* (September 2009), available online at http://www.nyc.gov/html/planyc2030/downloads/pdf/greenhousegas_2009.pdf.

5. City of New York, *Inventory of New York City Greenhouse Gas Emissions* (September 2010), available online at http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/greenhousegas_2010.pdf

6. City of New York, *Inventory of New York City Greenhouse Gas Emissions* (September 2011), available online at http:// www.nyc.gov/html/om/pdf/2011/pr331-11_report.pdf.

7. City of New York, Inventory of New York City Greenhouse Gas Emissions (September 2011), available online at http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/greenhousegas_2012.pdf.

8. California Air Resources Board (CARB), The California Climate Action Registry (CCAR), ICLEI – Local Governments for Sustainability (ICLEI), and The Climate Registry (TCR), *Local Government Operations Protocol*, Version 1.1 (May 2010), available online at http://www.theclimateregistry.org/downloads/2010/05/2010-05-06-LGO-1.1.pdf.

9. *Global Protocol For Community-Scale Greenhouse Gas Emissions*, Pilot Version 1.0 (May 2012), available online at http://www.ghgprotocol.org/files/ghgp/GPC_PilotVersion_1.0_May2012_20120514.pdf.

10. ICLEI Local Governments for Sustainability USA, *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*, Public Comment Draft (July 2012), available online at http://www.icleiusa.org/library/documents/community-protocol-public-comment-draft-final-2.

11. New York State Energy Research and Development Authority, *New York State Regional Greenhouse Gas Protocol*.

12. World Resources Institute and World Business Council for Sustainable Development, revised edition, available online at http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

13. Local Government Operations Protocol (LGOP) Version 1.1 (May 2010), pp. 14.

14. *Local Government Operations Protocol* (LGOP) Version 1.1 (May 2010), pp 14.

15. LGOP Version 1.1 (May 2010), pp 127.

16. LGOP Version 1.1 (May 2010), pp 113.

17. LGOP Version 1.1 (May 2010), pp 98

18. USCP Pilot Version 1.0 (May 2012), Appendix E, pp 19.

19. LGOP Version 1.1 (May 2010), pp 78.

20. LGOP Version 1.1 (May 2010), pp 203.

21. LGOP Version 1.1 (May 2010), pp 201.

22. U.S. Environmental Protection Agency, *Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model* (WARM), available online at http://www.epa.gov/climatechange/waste/SWMGHGreport.html

Appendix G

Weather Impacts on Emissions

In PlaNYC, the City estimated that more than 40 percent of all energy used within the city's buildings was used to heat or cool building spaces. As 74 percent of the city's GHG emissions are related to buildings, heating and cooling directly affects over 30 percent of the city's carbon footprint

To fully understand the impact of year-on-year changes in GHG emissions, the extent of weather's impact on energy use must be accounted for and is a key component in determining causes for interannual changes in the GHG carbon footprint. Steam (used for both heating and cooling), electricity (used for cooling via air-conditioners), natural gas (used for heating), and building oil (used for heating) use figures are correlated with monthly heating degree days (HDD) and cooling degree days (CDD).

The resulting correlation graphs show the relationship with each type of energy use and its corresponding weather statistics, and the strength of their relationship.

The exclusion of weather from year-on-year changes is based on these estimates; it is presented as an estimate rather than a detailed analysis, and further refinement of these methods will be necessary to make precise claims for exactly how weather affected greenhouse gas emissions.

The weather fluctuations are measured in degree days, in which one day at 66° would be one cooling degree day, and one day at 75° would be ten cooling degree days. (Conversely, one day at 55° would be ten heating degree days.)

Fig. 32: Correlation of Cooling & Heating Degree Days to Steam Use

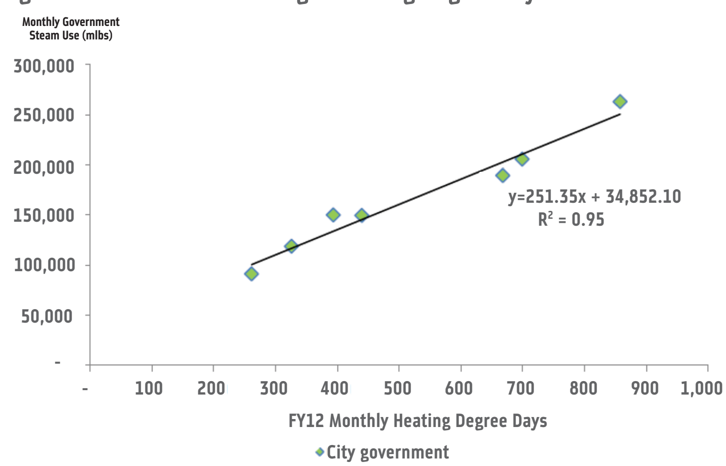


Fig. 34: Correlation of Cooling Degree Days to Electricity Use

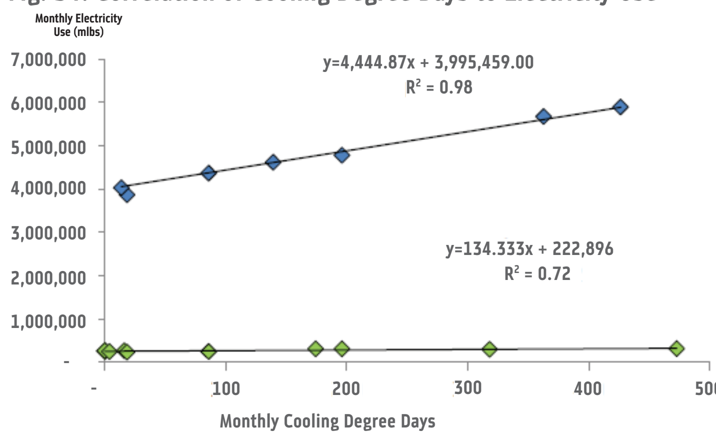


Fig. 33: Correlation of Heating Degree Days to Natural Gas Use

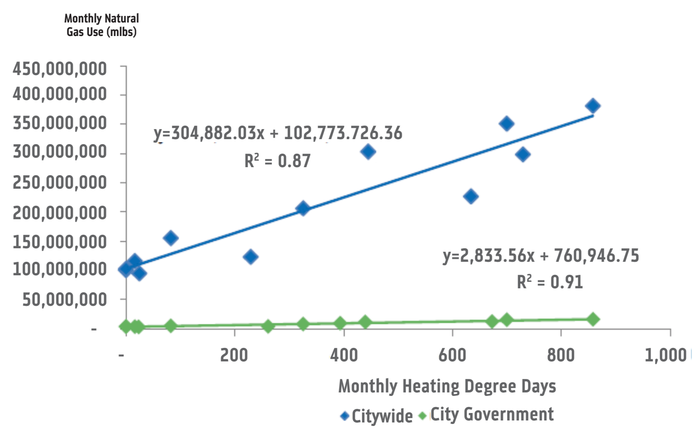
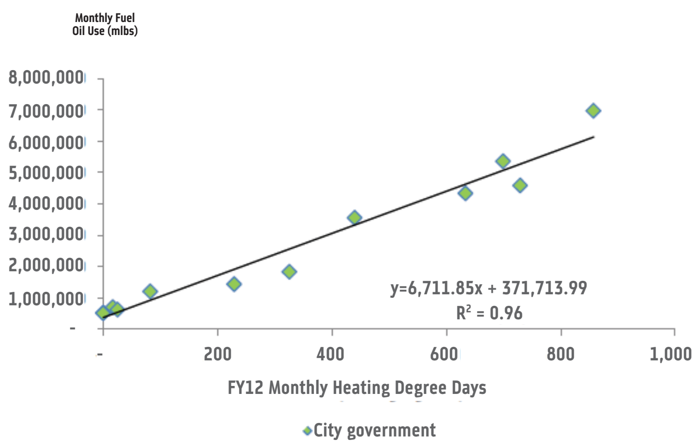


Fig. 35: Correlation of Heating Degree Days to Fuel Oil Use



Source: NOAA (CDD and HDD), citywide natural gas use, and municipal fuel oil, steam, and electricity use

Appendix H

Steam Emissions Coefficients

2005 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
104%	3.0939	190.520	0.00611	0.00109	190.9856

2006 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
125%	2.4357	155.695	0.00484	0.00084	156.0589

2007 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
120%	2.5226	161.529	0.00504	0.00088	161.9076

2008 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
123%	2.4630	153.961	0.00458	0.00078	154.2974

2009 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
115%	2.770	165.498	0.00501	0.00086	165.8690

2010 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficient - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
129%	2.4615	142.691	0.00405	0.00066	142.9816

2011 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
123%	2.5847	142.849	0.00373	0.00057	143.104

2012 STEAM EMISSIONS COEFFICIENTS					
To convert metered kg of steam to GJ		Steam coefficients - kg per metric ton delivered to buildings			
Steam Generation Efficiency	Total GJ input per metric ton steam	CO_2	CH_4	N_2O	CO_2e
147%	22,244	121.427376	0.002981	0.000429	121.622949

*Note: 64% of steam in 2012 is generated through cogeneration

Appendix I

Electricity Emissions Coefficients

2005 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
In-city	99,233,736	12,389,115	124.84782		0.00238	24.16796	0.00024	12,401,573	124.97335	245,764,278	2.47662
Contract	47,150,240	2,381,729	50.51362	44.92133	0.00095	4.49213	0.00010	2,384,065	50.56316	123,699,737	2.62352
Market procurement (G, H, I)	43,792,473	927,857	21.18758	23.17830	0.00053	8.67841	0.00020	931,034	21.26013	120,000,527	2.74021
Market procurement (ROS)	93,053	4,701	50.52347	0.07941	0.00085	0.03038	0.00033	4,712	50.64261	106,129	**1.14052**
PSEG Imports	2,287,296	224,799	49.14083	3.91185	0.00086	1.02583	0.00022	225,199	49.22830	6,709,088	**2.93320**
Total	192,556,798	15,928,202	82.13578		0.00159	38.39472	0.00020	17,578,099	82.23020	496,279,759	**2.57732**
Total 2012 NYC electricity use	186,199,651		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-3.30%		84.94002		0.00165		0.00020		85.03766		

2006 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
Total	191,145,600	19,483,628	101.931	350.69	0.00183	114.48	0.00060	19,523,913	102.141	530,574,952	**2.776**
Total 2006 NYC electricity use	181,779,844		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-4.90%		107.182		0.00193		0.00063		107.404		

2007 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
Total	197,100,000	20,490,670	103.961	380.45	0.00193	105.30	0.00053	20,531,065	104.166	545,104,748	**2.766**
Total 2007 NYC electricity use	188,202,200		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-4.51%		108.876		0.00202		0.00056		109.090		

2008 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
Total	197,406,000	18,292,678	92.665	335.34	0.00170	100.33	0.00051	18,327,855	92.843	520,646,315	**2.637**
Total 2008 NYC electricity use	186,150,634		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-5.70%		98.268		0.00180		0.00054		98.457		

2009 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
Total	191,160,000	16,092,212	84.182	306.54	0.00160	85.50	0.00045	16,120,898	84.332	479,457,933	**2.508**
Total 2009 NYC electricity use	182,649,671		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-4.45%		88.104		0.00168		0.00047		88.261		

2010 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
In-city	86,233,586	11,021,452	127.809	209.44	0.00243	21.24	0.00025	11,032,435	127.936	218,889,569	2.538
Contract	31,737,395	1,800,860	56.742	40.37	0.00127	4.04	0.00013	1,802,626	56.798	81,597,491	2.571
Market procurement (G, H, I)	56,673,573	2,318,994	40.918	39.13	0.00069	31.53	0.00056	2,329,592	41.105	158,573,038	2.798
Market procurement (ROS)	19,386,178	1,306,119	67.374	13.39	0.00069	10.79	0.00056	1,310,520	67.601	26,598,854	1.372
PSEG Imports	4,379,669	490,015	64.289	7.68	0.00101	3.79	0.00050	491,350	64.464	13,056,367	2.981
Total	198,410,400	16,937,439	84.315	310.01	0.00155	71.39	0.00035	16,966,523	84.459	498,715,319	**2.514**
Total 2010 NYC electricity use	190,666,800		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-3.90%		**87.739**		0.00161		0.00037		87.889		

2011 ELECTRICITY EMISSIONS COEFFICENTS

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
In-city	89,328,565	11,338,416	126.929	216	0.002	21.91	0.00025	11,349,738	127.056	225,121,498	2.520
Contract	33,546,524	1,860,287	55.454	35	0.00105	3.51	0.00010	1,862,112	55.508	86,718,208	2.585
Market procurement (G, H, I)	54,463,329	1,359,152	24.955	24	0.00044	17.52	0.00032	1,365,089	25.064	151,055,052	2.774
Market procurement (ROS)	13,466,559	794,721	59.014	6	0.00044	4.33	0.00032	797,191	59.198	16,946,742	1.258
PSEG Imports	3,811,022	423,024	55.500	7	0.00090	2.81	0.00037	424,041	55.633	11,130,854	2.921
Total	194,616,000	15,775,601	79.973	288	0.00146	50.00	0.00025	15,798,172	80.087	490,972,355	**2.523**
Total 2011 NYC electricity use	188,085,600		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-3.36%		82.750		0.00151		0.00026		82.867		

2012 Electricity Emissions Coefficients

	Generation (GJ)	CO_2 (Mg)	CO_2/GJ (kg)	CH_4 (Mg)	CH_4/GJ (kg)	N_2O (Mg)	N_2O/GJ (kg)	CO_2e (Mg)	CO_2e/GJ (kg)	Source energy (GJ)	Source GJ/GJ
In-city	99,233,736	12,389,115	124.84782	236.43559	0.00238	24.16796	0.00024	12,401,573	124.97335	245,764,278	2.47662
Contract	47,150,240	2,381,729	50.51362	44.92133	0.00095	4.49213	0.00010	2,384,065	50.56316	123,699,737	2.62352
Market procurement (G, H, I)	43,792,473	927,857	21.18758	23.17830	0.00053	8.67841	0.00020	931,034	21.26013	120,000,527	2.74021
Market procurement (ROS)	93,053	4,701	50.52347	0.07941	0.00085	0.03038	0.00033	4,712	50.64261	106,129	1.14052
PSEG Imports	2,287,296	224,799	49.14083	3.91185	0.00086	1.02583	0.00022	225,199	49.22830	6,709,088	2.93320
Total	192,556,798	15,928,202	82.13578	308.52648	0.00159	38.39472	0.00020	17,578,099	82.23020	496,279,759	**2.57732**
Total 2012 NYC electricity use	186,199,651		Coefficient with transmission and distribution losses								
Transmission and distribution loss rate	-3.30%		84.94002		0.00165		0.00020		85.03766		

Appendix J

Fuel Emissions Coefficients

2012 FUEL EMISSIONS COEFFICIENTS							
	UNIT	GREENHOUSE GAS (Kg/UNIT)					FUEL EFFICIENCY (Km/UNIT)
		CO_2	CH_4	N_2O	CO_2e	GJ/UNIT	
Stationary source							
Natural gas (buildings)	GJ	50.25326	0.00474	0.00009	50.38216	0.99995	
Natural gas (industrial)	GJ	50.25326	0.00095	0.00009	50.30254	0.99995	
#2 fuel oil (buildings)	liter	2.69627	0.00040	0.00002	2.71147	0.03846	
#2 fuel oil (industrial)	liter	2.69627	0.00011	0.00002	2.70534	0.03846	
#4 fuel oil (buildings)	liter	2.89423	0.00042	0.00002	2.91031	0.04069	
#4 fuel oil (industrial)	liter	2.89423	0.00012	0.00002	2.90383	0.04069	
#6 residual fuel oil (buildings)	liter	2.97590	0.00044	0.00002	2.99242	0.04181	
#6 residual fuel oil (industrial)	liter	2.97590	0.00012	0.00002	2.98576	0.04181	
100% biodiesel*	liter	2.49683	0.00004	0.00000	2.49876	0.03567	
Propane (industrial)	liter	1.47748	0.00007	0.00001	1.48346	0.02536	
Kerosene (industrial)	liter	2.68187	0.00011	0.00002	2.69075	0.03762	
Mobile source							
On-road							
Diesel - buses	liter	2.69720	0.00002	0.00002	2.70253	0.03849	5.38
Diesel - light trucks	liter	2.69720	0.00000	0.00000	2.69851	0.03849	4.38
Diesel - heavy-duty vehicles	liter	2.69720	0.00001	0.00001	2.70082	0.03849	3.65
Diesel - passenger cars	liter	2.69720	0.00000	0.00000	2.69854	0.03849	6.73
Gasoline - light trucks	liter	2.31968	0.00012	0.00017	2.37403	0.03484	6.21
Gasoline - passenger cars	liter	2.31943	0.00015	0.00016	2.37200	0.03484	8.72
100% biodiesel (B100) - heavy trucks*	liter	2.49710	0.00004	0.00000	2.49903	0.03568	3.65
100% ethanol (E100) - passenger cars*	liter	1.51899	0.00022	0.00027	1.60857	0.02342	6.58
Compressed natural gas - bus	GJ	50.28833	0.10395	0.00925	55.33978	1.00000	0.003233282
Off-road							
Aviation gasoline	liter	2.19527	0.00186	0.00003	2.24333	0.03350	
Diesel, locomotives	liter	2.52840	0.00007	0.00008	2.55529	0.03763	
Diesel, ships and boats	liter	2.69720	0.00021	0.00007	2.72293	0.03866	
Jet fuel	liter	2.69749	0.00020	0.00007	2.72289	0.03866	

*** Per the LGOP, CO_2 from biofuels is considered biogenic and is reported as an information source**
**** Per the LGOP, building usage here is identified as residential, commerical, or institutional**

Unit Conversions

Appendix K

Citywide GHG Emissions Summary

		CY 2005			CY 2011			CY 2012			Change from 2011			Change from 2005		
Sector	**Units**	**Consumed**	**MgCO2e**	**Source GJ**	**Consumed**	**MgCO2e**	**Source GJ**	**Consumed**	**MgCO2e**	**Source GJ**	**Consumed**	**MgCO2e**	**Source GJ**	**Consumed**	**MgCO2e**	**Source GJ**
Buildings																
Residential Large																
#2 fuel oil	liters	303,439,093	822,766	11,671,130	299,389,924	811,787	11,515,388	270,462,167	733,350	10,402,744	-10%	-10%	-10%	-11%	-11%	-11%
#4 fuel oil	liters	244,721,991	712,218	9,958,367	244,854,122	712,602	9,963,744	242,555,659	705,913	9,870,214	-1%	-1%	-1%	-1%	-1%	-1%
#6 fuel oil	liters	719,091,786	2,151,828	30,063,385	669,137,021	2,002,342	27,974,905	523,203,966	1,565,649	21,873,817	-22%	-22%	-22%	-27%	-27%	-27%
Biofuel	liters	170,954	0	6,099	867,980	2	30,966	23,953,771	46	854,567	2660%	2660%	2660%	13912%	13912%	13912%
Electricity	GJ	31,440,688	3,795,949	92,512,565	13,194,174	1,093,366	33,285,806	12,851,835	1,092,890	33,123,242	-3%	0%	0%	-59%	-71%	-64%
Natural gas	GJ	104,406,142	5,259,635	104,406,142	110,530,268	5,568,754	110,530,268	105,920,982	5,336,528	105,920,982	-4%	-4%	-4%	1%	1%	1%
Steam	kg	1,998,982,584	381,777	6,184,712	2,630,897,883	376,491	6,445,330	2,487,032,108	302,480	5,532,192	-5%	-20%	-14%	24%	-21%	-11%
Residential Small																
#2 fuel oil	liters	194,800,213	528,195	7,492,570	192,200,749	521,147	7,392,587	173,629,861	470,792	6,678,298	-10%	-10%	-10%	-11%	-11%	-11%
#4 fuel oil	liters	22,953,105	66,801	934,021	22,965,498	66,837	934,525	22,749,919	66,209	925,753	-1%	-1%	-1%	-1%	-1%	-1%
#6 fuel oil	liters	19,810,080	59,280	828,209	18,433,889	55,162	770,674	14,413,615	43,132	602,596	-22%	-22%	-22%	-27%	-27%	-27%
Biofuel	liters	26,143	0	933	504,923	1	18,013	7,102,821	14	253,398	1307%	1307%	1307%	27069%	27069%	27069%
Electricity	GJ	19,565,425	2,362,205	57,570,232	45,651,123	3,782,986	115,167,071	44,594,795	3,792,237	114,934,888	-2%	0%	0%	128%	61%	100%
Natural gas	GJ	75,901,131	3,823,647	75,901,131	46,021,216	2,318,648	46,021,216	43,226,964	2,177,868	43,226,964	-6%	-6%	-6%	-43%	-43%	-43%
Commercial																
#2 fuel oil	liters	154,911,538	420,038	5,958,338	152,844,358	414,433	5,878,829	138,076,178	374,390	5,310,802	-10%	-10%	-10%	-11%	-11%	-11%
#4 fuel oil	liters	35,555,560	103,478	1,446,847	35,574,757	103,534	1,447,628	35,240,814	102,562	1,434,039	-1%	-1%	-1%	-1%	-1%	-1%
#6 fuel oil	liters	68,582,661	205,228	2,867,265	63,818,275	190,971	2,668,079	49,900,056	149,322	2,086,193	-22%	-22%	-22%	-27%	-27%	-27%
Biofuel	liters	30,787	0	1,098	407,858	1	14,551	6,663,559	13	237,727	1534%	1534%	1534%	21544%	21544%	21544%
Electricity	GJ	65,849,174	7,950,212	193,757,722	66,483,222	5,509,285	167,721,566	66,894,083	5,688,517	172,407,205	1%	3%	3%	2%	-28%	-11%
Natural gas	GJ	37,688,178	1,898,605	37,688,178	62,807,943	3,164,400	62,807,943	61,315,943	3,089,230	61,315,943	-2%	-2%	-2%	63%	63%	63%
Steam	kg	4,661,116,454	890,206	14,421,168	3,603,080,420	515,613	8,827,041	3,094,581,285	376,372	6,883,633	-14%	-27%	-22%	-34%	-58%	-52%
Industrial																
#2 fuel oil	liters	65,089,976	176,091	2,503,546	64,221,399	173,741	2,470,138	58,016,177	156,954	2,231,467	-10%	-10%	-10%	-11%	-11%	-11%
#4 fuel oil	liters	10,293,146	29,890	418,855	10,298,704	29,906	419,081	10,202,029	29,625	415,147	-1%	-1%	-1%	-1%	-1%	-1%
#6 fuel oil	liters	7,001,414	20,905	292,711	6,515,031	19,452	272,377	5,094,158	15,210	212,974	-22%	-22%	-22%	-27%	-27%	-27%
Biofuel	liters	8,808	0	314	168,905	0	6,026	2,431,619	5	86,750	1340%	1340%	1340%	27508%	27508%	27508%
Electricity	GJ	31,607,604	3,816,102	93,003,706	32,240,481	2,671,682	81,335,168	32,126,591	2,731,970	82,800,383	0%	2%	2%	2%	-28%	-11%
Natural gas	GJ	18,090,325	911,331	18,090,325	22,218,676	1,117,656	22,218,676	21,322,137	1,072,558	21,322,137	-4%	-4%	-4%	18%	18%	18%
Steam	kg	2,237,335,898	427,299	6,922,160	1,729,478,602	247,494	4,236,980	1,485,399,017	180,659	3,304,144	-14%	-27%	-22%	-34%	-58%	-52%
Institutional																
#2 fuel oil	liters	127,423,583	345,505	4,901,073	125,723,210	340,895	4,835,672	113,575,539	307,957	4,368,438	-10%	-10%	-10%	-11%	-11%	-11%
#4 fuel oil	liters	12,218,749	35,560	497,212	12,225,347	35,580	497,481	12,110,586	35,246	492,811	-1%	-1%	-1%	-1%	-1%	-1%
#6 fuel oil	liters	22,087,978	66,097	923,442	20,553,543	61,505	859,291	16,070,991	48,091	671,887	-22%	-22%	-22%	-27%	-27%	-27%
Biofuel	liters	18,828	0	672	331,039	1	11,810	4,703,561	9	167,803	1321%	1321%	1321%	24881%	24881%	24881%
Electricity	GJ	25,596,261	3,090,330	75,315,649	19,787,713	1,639,754	49,919,755	19,005,566	1,616,189	48,983,354	-4%	-1%	-2%	-26%	-48%	-35%
Natural gas	GJ	22,612,907	1,139,163	22,612,907	30,209,921	1,522,041	30,209,921	28,275,843	1,424,598	28,275,843	-6%	-6%	-6%	25%	25%	25%
Steam	kg	2,796,669,872	534,124	8,652,701	2,161,848,247	309,368	5,296,225	1,856,748,767	225,823	4,130,180	-14%	-27%	-22%	-34%	-58%	-52%
Buildings Sub-Total																
#2 fuel oil	liters	845,664,403	2,292,596	32,526,657	834,379,640	2,262,003	32,092,613	753,759,922	2,043,443	28,991,750	-10%	-10%	-10%	-11%	-11%	-11%
#4 fuel oil	liters	325,742,551	947,946	13,255,303	325,918,428	948,458	13,262,459	322,859,007	939,555	13,137,964	-1%	-1%	-1%	-1%	-1%	-1%
#6 fuel oil	liters	836,573,919	2,503,338	34,975,012	778,457,758	2,329,433	32,545,324	608,682,787	1,821,404	25,447,468	-22%	-22%	-22%	-27%	-27%	-27%
Biofuel	liters	255,520	0	9,116	2,280,706	4	81,366	44,855,331	87	1,600,244	1867%	1867%	1867%	17454%	17454%	17454%
Electricity	GJ	174,059,153	21,014,798	512,159,873	177,356,713	14,697,073	447,429,366	175,472,870	14,921,803	452,249,072	-1%	2%	1%	1%	-29%	-12%
Natural gas	GJ	258,698,683	13,032,381	258,698,683	271,788,024	13,691,499	271,788,024	260,061,868	13,100,781	260,061,868	-4%	-4%	-4%	1%	1%	1%
Steam	kg	11,694,104,807	2,233,406	36,180,740	10,125,305,153	1,448,966	24,805,576	8,923,761,177	1,085,334	19,850,150	-12%	-25%	-20%	-24%	-51%	-45%
Transportation																
Biofuel	liters	-	-	-	-	-	-	-	-	-						
CNG - transit bus	GJ	249,113	13,786	249,113	1,365,414	75,562	1,365,414	1,405,919	77,803	1,405,919	3%	3%	3%	464%	464%	464%
Diesel - commuter rail	liters	5,207,217	14,179	201,286	5,189,708	14,131	200,610	4,740,572	12,908	183,248	-9%	-9%	-9%	-9%	-9%	-9%
Diesel - heavy trucks	liters	354,347,537	957,027	13,638,620	319,229,257	862,179	12,286,939	320,416,950	865,387	12,332,652	0%	0%	0%	-10%	-10%	-10%
Diesel - light trucks	liters	29,530,997	79,696	1,136,630	34,457,788	92,985	1,326,259	34,586,226	93,331	1,331,203	0%	0%	0%	17%	17%	17%
Diesel - non-transit bus	liters	68,793,026	185,923	2,647,801	7,151,847	19,328	275,270	7,196,897	19,450	277,004	1%	1%	1%	-90%	-90%	-90%
Diesel - passenger cars	liters	13,842,098	37,354	532,774	13,876,803	37,447	534,110	13,928,625	37,587	536,104	0%	0%	0%	1%	1%	1%
Diesel - solid waste transport - rail	liters	3,029,923	8,250	117,135	6,594,574	17,957	254,943	6,442,222	17,542	249,053	-2%	-2%	-2%	113%	113%	113%
Diesel - solid waste transport - truck	liters	48,753,438	131,674	1,876,694	25,710,509	69,439	989,690	24,715,442	66,752	951,386	-4%	-4%	-4%	-49%	-49%	-49%
Diesel - transit bus	liters	182,539,690	493,340	7,025,841	178,796,163	483,202	6,881,755	179,922,538	486,246	6,925,108	1%	1%	1%	-1%	-1%	-1%
Electricity - subway and commuter rail	GJ	9,823,257	1,185,998	28,904,417	9,644,365	799,203	24,330,469	9,937,263	845,042	25,611,469	3%	6%	5%	1%	-29%	-11%
Ethanol	liters	396,268,834	35,498	9,282,771	385,727,585	34,554	9,035,837	391,634,713	35,083	9,174,214	2%	2%	2%	-1%	-1%	-1%
Gasoline - light trucks	liters	386,314,029	920,049	13,459,000	388,993,934	923,384	13,552,367	389,961,536	925,681	13,586,077	0%	0%	0%	1%	1%	1%
Gasoline - passenger cars	liters	3,191,760,461	7,597,890	111,199,440	3,211,033,697	7,616,569	111,870,910	3,219,043,701	7,635,569	112,149,975	0%	0%	0%	1%	0%	1%
Streetlights and traffic signals																
Electricity	GJ	1,148,131	138,618	3,378,315	802,041	66,463	2,023,361	789,520	67,139	2,034,844	-2%	1%	1%	-31%	-52%	-40%
Fugitive and process emissions																
CH4 - exported solid waste	Mg	6,839,459	2,475,157		5,813,747	1,966,863		5,837,854	2,015,252		0%	2%		-15%	-19%	
CH4 - landfills	Mg	14,398	302,358		7,165	150,457		6,582	138,216		-8%	-8%		-54%	-54%	
CH4 - natural gas distribution	GJ	809,581	318,789		781,844	318,400		670,287	263,939		-14%	-17%		-17%	-17%	
CH4 - wastewater treatment plants	Mg	6,536	137,444		9,935	208,801		7,420	155,984		-25%	-25%		14%	13%	
N2O - wastewater treatment plants	Mg	286	88,547		285	88,248		259	80,249		-9%	-9%		-9%	-9%	
SF6 - electricity distribution	Mg	85,254	2,037,561		8,085	193,229		7,844	187,463		-3%	-3%		-91%	-91%	
TOTALS																
TOTAL Scope 1			74,160,094	1,388,637,261		65,814,705	1,330,348,617		62,916,867	1,289,679,754		-4%	-3%		-15%	-7%
TOTAL Scope 2			24,572,820	580,623,345		17,011,705	498,588,773		16,919,318	499,745,534		-1%	0%		-31%	-14%
TOTAL Scope 3 (included in city total)			2,475,157	-		1,966,863	-		2,015,252	-		2%			-19%	
TOTAL Scope 1, 2, and 3*			**101,208,071**	**1,969,260,606**		**84,793,272**	**1,828,937,390**		**81,851,437**	**1,789,425,288**		**-3%**	**-2%**		**-19%**	**-9%**
Information Items																
Aviation emissions			14,345,894			15,045,713			15,426,643			3%			8%	
Biogenic CO2 from ethanol			601,928			597,567			572,992			-4%			-5%	
Biogenic CO2 from biofuel - buildings			638			5,695			111,996			1867%			17454%	
TOTAL Scope 3 (not included in city total)			**14,948,460**			**15,648,974**			**16,111,630**			**3%**			**8%**	

Appendix L

City Government GHG Emissions Summary

Sector	Units	FY 2006			FY 2011			FY 2012			Change from 2011			Change from 2006		
		Consumed	MgCO2e	Source GJ	Consumed	MgCO2e	Source GJ	Consumed	MgCO2e	Source GJ	Consumed	MgCO2e	Source GJ	Consumed	MgCO2e	Source GJ
Buildings																
#2 fuel oil	liters	56,816,067	154,055	2,185,191	46,838,010	127,000	1,801,427	39,420,717	106,888	1,516,233	-16%	-16%	-16%	-31%	-31%	-31%
#4 fuel oil	liters	32,426,496	94,371	1,319,448	28,033,289	81,586	1,140,686	28,070,278	81,693	1,142,252	0%	0%	0%	-13%	-13%	-13%
#6 fuel oil	liters	75,041,558	224,556	3,137,129	67,193,640	201,072	2,809,045	48,814,689	146,074	2,040,817	-27%	-27%	-27%	-35%	-35%	-35%
Biodiesel	liters	-	-	-	239,376	0	8,539	394,616	1	14,078	65%	65%	65%	-	-	-
Electricity	GJ	11,518,736	1,237,160	31,971,468	12,354,733	1,023,803	31,166,437	11,898,665	1,011,835	30,666,622	-4%	-1%	-2%	3%	-18%	-4%
Kerosene	liters	-	-	-	63	0	2	37,252	100	1,402	59476%	59476%	59479%	-	-	-
Natural gas	GJ	11,068,300	557,645	11,067,713	12,530,186	631,298	12,529,521	9,960,477	501,830	9,959,948	-21%	-21%	-21%	-10%	-10%	-10%
Propane	liters	4,086,926	6,063	103,652	4,605,107	6,832	116,794	3,850,792	5,713	97,668	-16%	-16%	-16%	-6%	-6%	-6%
Steam	kg	781,066,529	121,892	2,007,102	905,309,589	129,553	2,339,865	770,832,430	93,751	1,714,651	-15%	-28%	-27%	-1%	-23%	-15%
Transportation																
Gasoline	liters	51,838,820	122,962	1,806,040	45,502,244	107,931	1,585,277	43,741,371	103,754	1,523,929	-4%	-4%	-4%	-16%	-16%	-16%
Ethanol	liters	5,972,192	535	139,901	4,886,910	438	114,478	4,768,709	427	111,709	-2%	-2%	-2%	-20%	-20%	-20%
Diesel - trucks	liters	60,061,625	162,215	2,311,612	61,233,609	165,381	2,356,719	56,925,436	153,745	2,191,025	-7%	-7%	-7%	-5%	-5%	-5%
Biodiesel - trucks	liters	-	-	-	2,239,955	4	79,908	2,104,903	4	75,094	-6%	-6%	-6%	-	-	-
Diesel - marine vessels	liters	18,247,504	49,681	705,325	18,280,116	49,769	706,586	17,185,238	46,788	664,300	-6%	-6%	-6%	-6%	-6%	-6%
Diesel - solid waste transport - rail	liters	3,286,649	8,949	127,040	6,221,020	16,939	240,463	6,646,281	18,097	256,942	7%	7%	7%	102%	102%	102%
Diesel - solid waste transport - truck	liters	47,235,003	127,573	1,817,950	25,136,183	67,888	967,425	23,764,890	64,185	914,796	-5%	-5%	-5%	-50%	-50%	-50%
Jet fuel	liters	933,093	2,384	35,107	783,874	2,003	29,493	684,946	1,750	25,772	-13%	-13%	-13%	-27%	-27%	-27%
CNG	GJ	-	-	-	-	-	-	3,785	209	3,785	-	-	-	-	-	-
Streetlights and traffic signals																
Electricity	GJ	1,102,486	118,412	3,355,153	770,764	63,871	1,961,695	759,273	64,567	1,956,888	-1%	1%	0%	-31%	-45%	-42%
Wastewater treatment																
#2 fuel oil	liters	18,314,093	49,546	704,375	19,071,722	51,596	733,555	18,478,502	49,991	710,736	-3%	-3%	-3%	1%	1%	1%
#4 fuel oil	liters	1,129,823	3,281	45,973	1,122,601	3,260	45,679	172,183	500	7,007	-85%	-85%	-85%	-85%	-85%	-85%
Biodiesel	liters	-	-	-	379	0	14	1,281	0	46	239%	239%	239%	-	-	-
Gasoline	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethanol	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electricity	GJ	2,145,924	230,481	5,956,238	2,413,207	199,976	6,141,930	2,383,615	202,697	6,143,330	-1%	1%	0%	11%	-12%	3%
Kerosene	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural gas	GJ	380,655	19,148	380,635	446,645	22,467	446,621	374,871	18,857	374,851	-16%	-16%	-16%	-2%	-2%	-2%
Propane	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steam	kg	106,123,696	16,562	272,705	105,527,584	15,101	272,747	114,367,916	13,910	254,402	8%	-8%	-7%	8%	-16%	-7%
Methane	Mg		148,426			202,997			176,151			-13%			19%	
Nitrous oxide	Mg		83,134			83,357			83,338			0%			0%	
Water supply																
#2 fuel oil	liters	234,386	634	9,015	276,694	749	10,648	553,614	1,498	21,294	100%	100%	100%	136%	136%	136%
Biodiesel	liters	-	-	-	3,914	0	140	7,619	0	272	95%	95%	95%	-	-	-
Electricity	GJ	83,711	8,991	232,348	90,607	7,508	230,606	141,743	12,053	365,317	56%	61%	58%	69%	34%	57%
Kerosene	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural gas	GJ	2,921	147	2,921	6,509	327	6,508	20,810	1,047	20,810	220%	220%	220%	612%	612%	612%
Propane	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steam	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solid waste facilities																
Methane	Mg		293,566			161,362			144,591			-10%			-51%	
Fugitive and process emissions																
HFCs - municipal vehicle fleet	Mg		11,370			10,645			10,838			2%			-5%	
TOTALS																
TOTAL Scope 1			2,120,240	25,899,027		1,994,900	25,729,528		1,718,070	21,674,765		-14%	-16%		-19%	-16%
TOTAL Scope 2			1,733,497	43,795,016		1,439,813	42,113,279		1,398,813	41,101,209		-3%	-2%		-19%	-6%
TOTAL Scope 1 and 2			**3,853,738**	**69,694,043**		**3,434,713**	**67,842,807**		**3,116,883**	**62,775,973**		**-9%**	**-7%**		**-19%**	**-10%**
Information Items																
Employee commute			224,207			192,733			191,282			-1%			-15%	
Employee solid waste			174,178			172,809			171,239			-1%			-2%	
Biogenic CO2e from ethanol and biodiesel			8,966			14,223			14,103			-1%			57%	
TOTAL Scope 3 (not included in city total)			**407,351**			**379,765**			**376,623**			**-1%**			**-8%**	

*** Per the forthcoming GCP, emissions from solid waste managed outside a City's boundary are considered a Scope 3 source that counts toward a city's total emissions figure. Other Scope 3 sources (e.g. aviation emissions) are reported as infromation only.**

Appendix M

Heating and Cooling Degree Days

Heating and Cooling Degree Days, Central Park 2005-2012 Using 65 Degrees (°F) Base Temperature

	YEAR	ANNUAL TOTAL	% CHANGE FROM PREVIOUS YEAR	% CHANGE FROM BASE YEAR
	Calendar years			
Heating degree days	2005	4,796		
Heating degree days	2006	4,051	-15.55%	-15.55%
Heating degree days	2007	4,763	17.59%	-0.69%
Heating degree days	2008	4,656	-2.25%	-2.92%
Heating degree days	2009	4,824	3.61%	0.58%
Heating degree days	2010	4,502	-6.67%	-6.13%
Heating degree days	2011	4,395	-2.40%	-8.38%
Heating degree days	2012	4,040	-8.08%	-15.78%
Cooling degree days	2005	1,437		
Cooling degree days	2006	1,099	-23.48%	-23.48%
Cooling degree days	2007	1,179	7.27%	-17.92%
Cooling degree days	2008	1,137	-3.59%	-20.86%
Cooling degree days	2009	843	-25.85%	-41.32%
Cooling degree days	2010	1,513	79.50%	5.33%
Cooling degree days	2011	1,298	-14.21%	-9.63%
Cooling degree days	2012	1,247	-3.99%	-13.24%
	Fiscal years			
Heating degree days	2006	4,319		
Heating degree days	2007	4,521	4.68%	4.68%
Heating degree days	2008	4,531	0.20%	4.89%
Heating degree days	2009	4,896	8.07%	13.36%
Heating degree days	2010	4,433	-9.46%	2.63%
Heating degree days	2011	4,784	7.92%	10.77%
Heating degree days	2012	3,773	-21.14%	-12.65%
Cooling degree days	2006	1,401		
Cooling degree days	2007	1,147	-18.16%	-18.16%
Cooling degree days	2008	1,169	1.96%	-16.56%
Cooling degree days	2009	1,026	-12.27%	-26.80%
Cooling degree days	2010	1,075	4.85%	-23.25%
Cooling degree days	2011	1,405	30.64%	0.27%
Cooling degree days	2012	1286	-8.47%	-8.22%

Source: http://cdo.ncdc.noaa.gov/pls/plclimprod/somdmain.somdwrapper?datasetabbv=DS3220&countryabbv=&georegionabbv=NAMER

In previous years, the City of New York included here the HDD/CDD "Annual Summaries" as reported on NOAA's National Climatic Data Center website. This year, as weather played a large part in the Inventory, a more detailed calculation was completed consisting of analyzing daily recorded temperatures. As such, the annual totals reported above vary slightly from earlier versions of this table.

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