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INVENTORY OF NEW YORK CITY GREENHOUSE GAS EMISSIONS

SEPTEMBER 2010

A GREENER, GREATER NEW YORK

The City of New York
Mayor Michael R. Bloomberg

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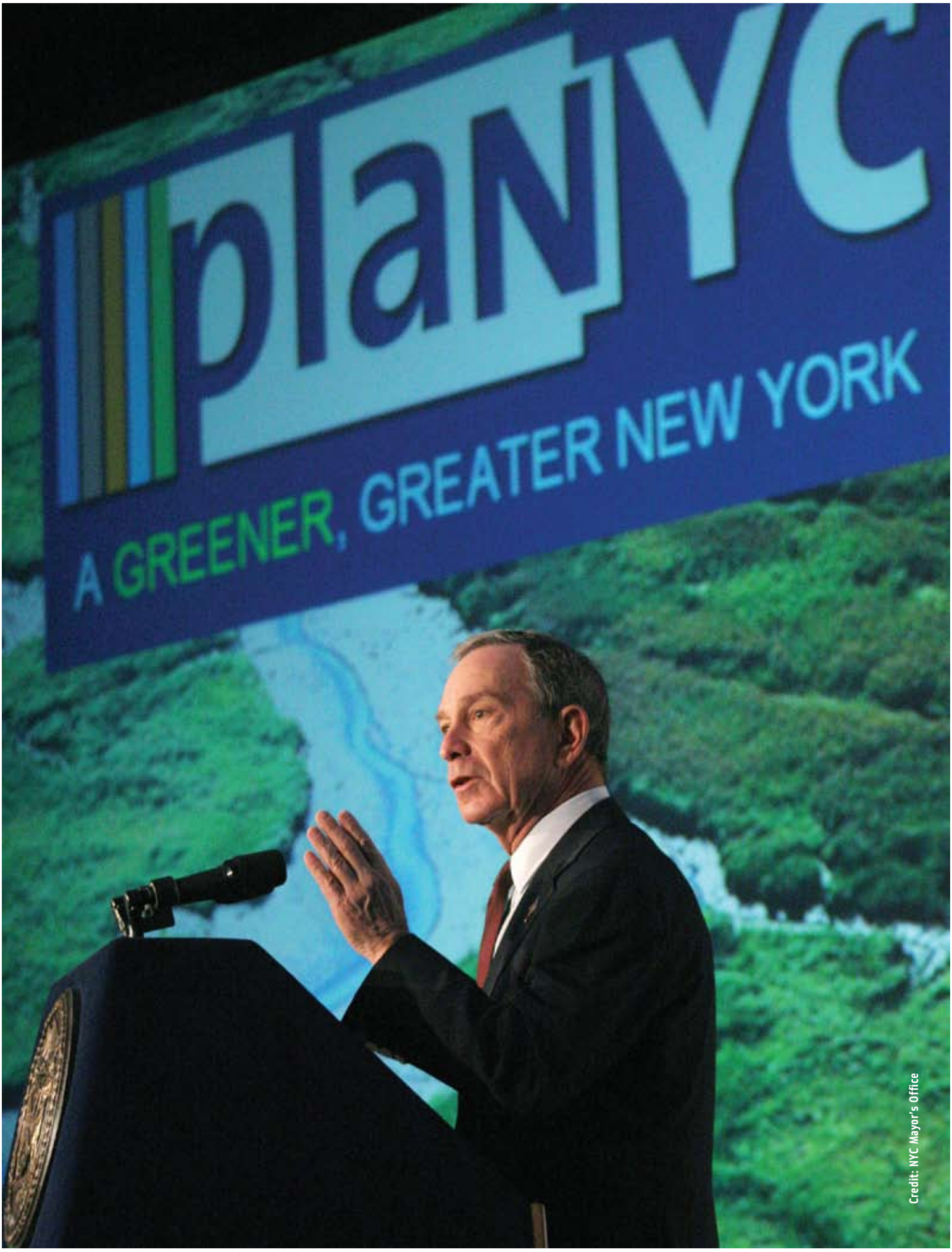


Credit: NYC Mayor's Office

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

New York City is one of the most energy-efficient cities in the world. Even so, climate change continues to pose a serious threat not only to our city, but also to the world. That is why we have taken great strides in recent years to reduce our greenhouse gas emissions and further increase our energy efficiency, while also making New York City more resilient to the projected impacts of climate change. While a comprehensive climate strategy has stalled in Congress and a new international climate agreement has yet to be realized, other cities around the world have joined New York in doing their part to reduce their contributions to global climate change. In all our efforts, it is absolutely critical that we regularly assess the progress we are making toward our goals.

New York City is dedicated to taking accurate measurements before tackling any major challenge. This is why we completed a full accounting of our city's greenhouse gas emissions before the 2007 release of *PlaNYC*, our comprehensive sustainability plan. This initial assessment has allowed us to focus our policy initiatives—such as improving the energy efficiency of the city's existing large buildings through landmark green buildings legislation—and ensure that we are implementing the most effective carbon mitigation strategies.

This year's carbon inventory, covering 2009 emissions, demonstrates that we remain on track to achieve our *PlaNYC* carbon reduction goals: per capita energy consumption continues to decline, our electricity has become cleaner, and City government is well on its way to meeting its emissions reduction targets.

In both the public and private sector, you cannot manage what you do not measure. Regular, accurate carbon emissions inventories allow New York City to track our carbon mitigation efforts and to determine where we may need to amend these strategies to achieve our goals. These updates also provide transparent data for New Yorkers to use in holding us accountable for building a greener, greater New York.

Mayor Michael R. Bloomberg

Credit: NYC Economic Development Corporation

Executive Summary

In April 2007, the City of New York released its first-ever inventory of greenhouse gas emissions from both municipal government operations and the city at large, establishing the baseline from which the City's greenhouse gas (GHG) emissions reduction targets are based: a 30 percent reduction in citywide emissions below 2005 levels by 2030, and a 30 percent reduction in municipal government emissions below fiscal year 2006 by 2017.

Both citywide and municipal government emissions declined from 2008 to 2009. The largest portion of this change was due to the reduced carbon intensity of the city's electricity supply, as the city benefited from reduced coal-fired electricity generation in upstate New York, as well as other system improvements. Reduced per capita electricity and heating fuel use offset increased emissions citywide due to population growth and a continued expansion of building stock. Including these factors, citywide carbon emissions decreased by 4.2 percent below 2008 levels, while municipal carbon emissions decreased by 3.5 percent below fiscal year 2008 levels and 4.8 percent below calendar year 2008 levels. **Citywide carbon emissions were 12.9 percent below 2005 levels in 2009, and municipal government carbon emissions were 1.1 percent below fiscal year 2006 levels in fiscal year 2009.**

This report contains the citywide inventory for calendar year 2009 and the inventories of municipal government operations covering both fiscal and calendar year 2009. In 2009, New York City emitted 49.3 million metric tons of carbon dioxide equivalent ($MMTCO_2e$), while City government was responsible for 3.5 million metric tons in both fiscal and calendar 2009. These figures include GHG emissions generated by energy consumption in buildings (including emissions related to power generation in and outside the city), vehicles and transit operations within the city, emissions from landfills, wastewater treatment facilities, and electricity distribution within the city, and emissions associated with the transportation of solid waste to points outside the city. On a per capita basis, the average New Yorker was responsible for approximately 5.9 metric tons of greenhouse gas emissions in 2009, compared with 19.0 for the average American, excluding non-local emissions such as the agriculture sector.

Citywide per capita electricity and heating fuel consumption declined from 2008 to 2009, after taking out the modeled impact of weather, demonstrating that New Yorkers and their buildings are becoming more energy-efficient. While reduced transit bus fuel consumption and improved vehicle fuel economy also reduced emissions, when counting only those factors under our control, citywide emissions decreased by 2.5 percent, fiscal year 2009 municipal emissions decreased 0.9 percent, and calendar year 2009 municipal emissions decreased by 0.5 percent.

For the first time, both fiscal year and calendar year periods reported here show that the annual reduction in municipal emissions is now on the trajectory necessary to achieve a 30 percent reduction by 2017. Some of the reductions in municipal emissions indicate that the City's efforts to meet its PlaNYC goal of a 30 percent reduction in municipal government emissions below fiscal year 2006 by fiscal year 2017 are beginning to show returns. The City's investments in energy efficiency upgrades to its buildings laid out in the *Long-Term Plan to Reduce Municipal Energy and Greenhouse Gas Emissions of Municipal Buildings and Operations* have resulted in reduced heating fuel consumption in City buildings when adjusted for weather. These results, coupled with reductions in vehicle fleet fuel consumption and the increased efficiency of streetlights, show the initial impact of concerted efforts to make City government more energy-efficient.

In September 2008, the first annual update to these inventories was released in compliance with Local Law 22 of 2008, allowing the City to begin to track the progress it is making toward its goals. In September 2009, the City released its second annual updated GHG inventory, showing for the first time that New Yorkers themselves are beginning to become more energy-efficient. Because standards for municipal carbon accounting are continually evolving, each year the City updates its calculations to take into account new protocols, methodologies, and data availability. To allow for consistent year-to-year comparisons, the City has also updated its inventories for previous years in consideration of these changes. As was seen last year, these changes once again have resulted in decreases in both the citywide and municipal inventories for earlier base and interim years.

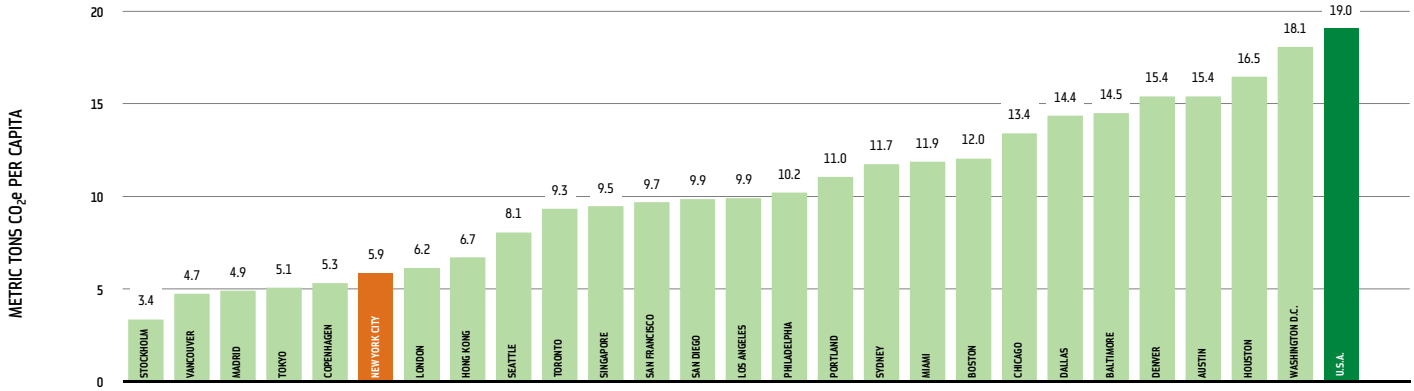
Comparison of New York City to Other Cities

Due to the high population density of New York City's built environment and extensive public transit system, New Yorkers' activities emit far less carbon than do those of residents of other comparable American cities and emit about a third as much carbon as the activities of the average U.S. resident. Driving this are the city's high rate of commutation by public transit and walking, low automobile ownership, and low per capita electricity consumption.

GHG EMISSIONS COMPARISONS

When compared to other large cities in the United States and abroad, New York City has one of the lowest per capita carbon emissions levels and the lowest of any large American city.

Figure 1: Per Capita Greenhouse Gas Emissions for U.S. and International Cities (excluding Agriculture and Non-Local Processes*)



* City greenhouse gas inventories do not typically include all sources of emissions included in the U.S. greenhouse gas inventory, including emissions from agriculture, chemical production, fossil fuel extraction and refinement, cement production, and other industrial sources. To allow for comparability between city and U.S. per capita GHG emissions, the U.S. per capita GHG emissions have been reduced by 2.3 metric tons per person, which, based on the U.S. GHG inventory, is the U.S. per capita share of GHG emissions from sources not accounted for in city inventories. Per the Kyoto Protocol, national inventories do not include emissions from aviation and shipping. Accordingly, city inventories also exclude these emissions sources.

Sources: U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008 (April 2010); city greenhouse gas inventories; New York City Mayor's Office of Long-Term Planning and Sustainability analysis.

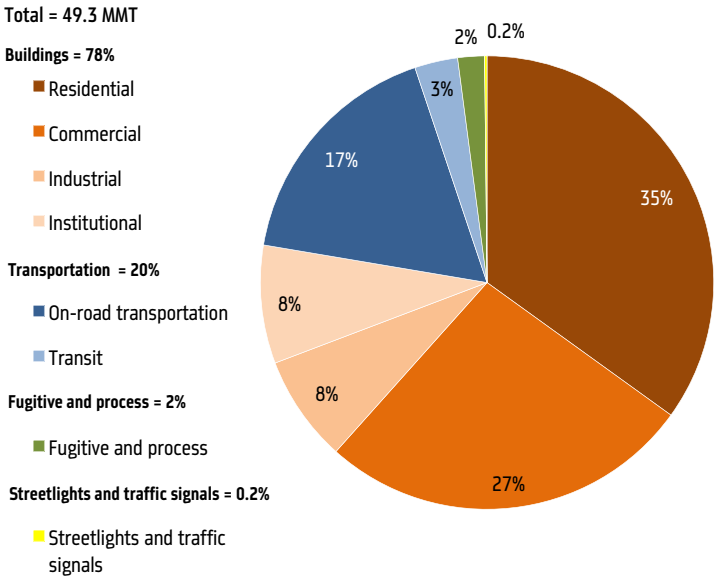
NEW YORK CITY GHG EMISSIONS

As with many cities, New York City's greenhouse gas emissions are dominated by two sectors: energy consumed in transportation and energy consumed in buildings. Roughly 78 percent of New York City's GHG emissions are related to heating, cooling, powering, and lighting buildings, and 20 percent are related to transportation.

The key drivers of transportation-related emissions are the portion of trips made by low-carbon modes, such as transit, walking, or cycling; the fuel efficiency of vehicles used; and the distances traveled.

The key drivers of building-related emissions include the types of fuel used for electricity generation; the efficiency of power plants; the size of the spaces inhabited by each person; weather demands on heating and cooling; the efficiency of buildings and workplaces; and personal efficiency measures.

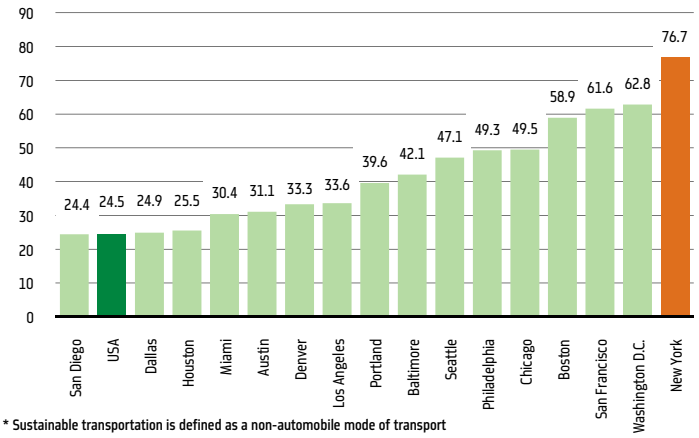
Figure 2: 2009 Citywide CO_2e Emissions by Sector



TRANSPORTATION COMPARISONS

One factor behind New York City's low per capita carbon emissions is its transit system. When compared to other U.S. cities and the U.S. average, New York City has the highest use of sustainable transportation, the most households without cars, and among the most commuters who walk to work.

Figure 3: Percentage of Commuters Using Sustainable Transport*



* Sustainable transportation is defined as a non-automobile mode of transport

Figure 4: Percentage of Households Without Cars

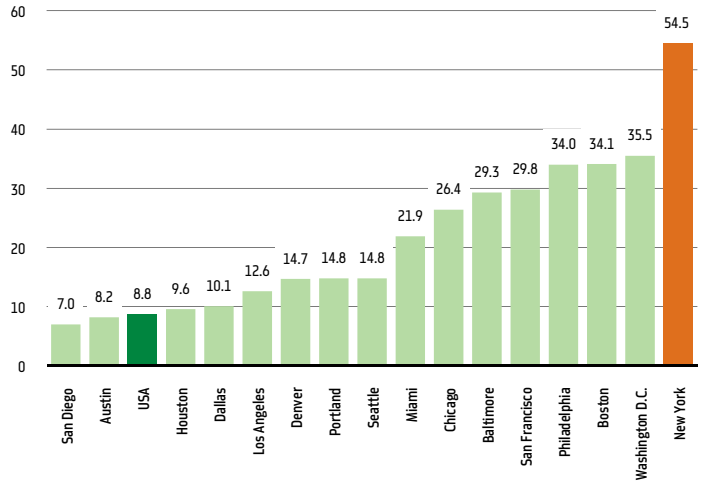
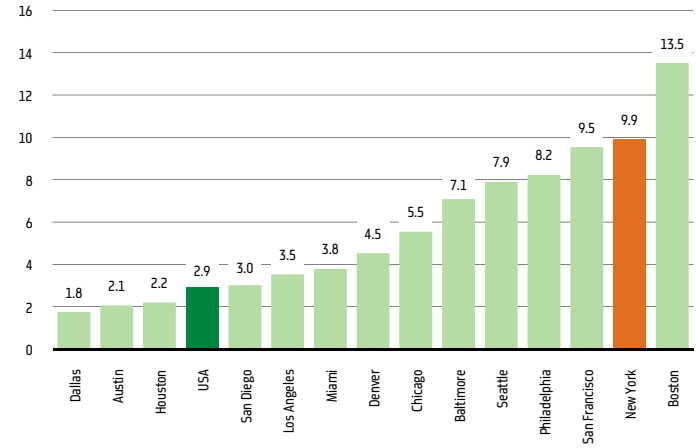


Figure 5: Percentage of Commuters Walking to Work



ELECTRICITY CONSUMPTION COMPARISONS

Electricity consumption is one indicator of building energy efficiency. New York City has among the lowest levels of per capita electricity use, both citywide and residential. This is driven largely by the fact that most New Yorkers live in apartment buildings and have smaller homes than the average American.

Figure 6: Annual Electricity Consumed Per Capita, MWh

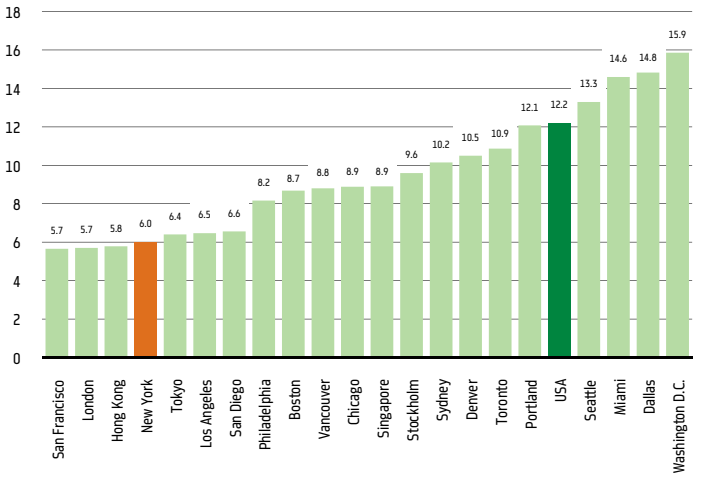
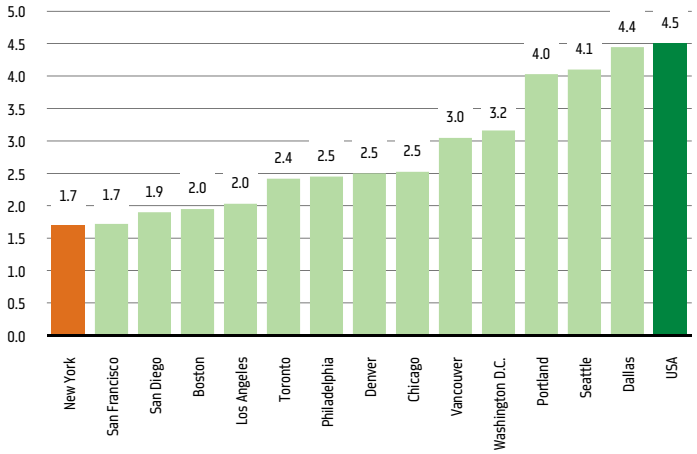


Figure 7: Annual Residential Electricity Consumed Per Capita, MWh



Source: For transportation data - U.S. Census Bureau, 2008 American Community Survey. For electricity consumption data - see Appendix for sources on municipal and U.S. electricity consumption

Credit: NYC Economic Development Corporation

Greenhouse Gas Emissions and Climate Change

The international scientific community has broadly agreed that human activity is changing the Earth's climate through increasing concentrations of greenhouse gases in the atmosphere. Greenhouse gases are a key element of the earth's atmosphere because they trap energy from the sun, creating a natural "greenhouse effect." Without this effect, temperatures would be much lower than they are now, and life as it exists today would not be possible.

This natural balance of GHG in the atmosphere, however, is being disturbed by human activities such as industrial processes, fossil fuel combustion, and changes in land use—actions that release large amounts of certain greenhouse gases into the atmosphere. This increase in greenhouse gas concentration traps additional energy in the lower atmosphere, thus warming it beyond its normal temperature. Through the ever-increasing combustion of fossil fuels for energy generation, industrial activity has contributed to a 30 percent increase in the global CO_2 levels since the beginning of the Industrial Revolution. Other anthropogenic contributions of greenhouse gases include the clearing of forests for development and agriculture, methane production from the decomposition of solid waste and agriculture, and the manufacturing of chlorofluorocarbons.

The term "global climate change" refers to the destabilizing impacts on climate and weather patterns that result from the continuous addition of these gases, the resultant increase in heat energy in the earth's atmosphere, and the associated changes that follow. Even small changes in the average temperatures can be accompanied by an increase in frequency and intensity in severe weather events such as storms and droughts, ecosystem change, loss of animal and plant species, stresses to human health, and alterations in regional agricultural productivity.

To help avoid some of these serious consequences of climate change, it is imperative for the global community to work together to collectively reduce GHG emissions. This is especially important in the world's cities which, while less carbon intensive than suburban and rural areas in developed countries, are estimated to be responsible for 80 percent of the world's GHG emissions. To allow New York City to effectively manage its share of world GHG emissions, it is necessary to complete accurate and regular assessments and analyses of its GHG emissions, the results of which are presented in this inventory.

Credit: NYC Department of Transportation

Overview

New York City meets annual greenhouse gas reduction targets and is on-track to achieve PlaNYC's carbon reduction goals

The City of New York established the goal of reducing citywide greenhouse gas emissions by 30 percent below 2005 levels by 2030 in its 2007 comprehensive sustainability plan, *PlaNYC*. Following the release of *PlaNYC*, Mayor Bloomberg signed Executive Order 109 in October 2007, which mandated even more aggressive greenhouse gas reductions for municipal facilities and operations of 30 percent below fiscal year 2006 (July 1, 2005 to June 30, 2006) levels by 2017.

Informing both the citywide and municipal greenhouse gas reduction efforts was New York City's first comprehensive greenhouse gas inventory, the *Inventory of New York City Greenhouse Gas Emissions*, released in April 2007 (*2007 Inventory*) and establishing the baseline on which the city's greenhouse gas reduction targets are based.[1] In January 2008 the New York City Council passed Local Law 22 of 2008, which requires the city to complete annual updates to both the citywide and municipal government greenhouse gas inventories, and to document progress the City is making toward achieving its goals. In accordance with this law, the City released its first annual updated greenhouse gas inventory, the *Inventory of New York City Greenhouse Gas Emissions* on September 17, 2008 (*2008 Inventory*)[2] and the *Inventory of New York City Greenhouse Gas Emissions: September 2009* on September 29, 2009 (*2009 Inventory*).[3] This document (*2010 Inventory*) is the City's third annual greenhouse gas inventory update.

Methodologies and protocols for the quantification and analysis of greenhouse gas emissions are continually evolving, and New York City has been a leading contributor to the development of updated standards. This inventory reports three things:

- Total 2009 GHG emissions (carbon footprint) for New York City, both citywide and for fiscal and calendar year 2009 municipal government operations and facilities
- Updates to past base year and interim year inventories, applying current protocols and methodologies and incorporating more accurate data
- Primary drivers of the changes in the city's carbon footprint from 2008 to 2009, both citywide and for City government

The citywide carbon footprint was lower in 2009 than 2008. After adjusting base and interim GHG emissions levels, the City reports a decrease of 2.2 $MMTCO_2e$ citywide emissions below 2008 levels, a 4.2 percent reduction. 2009 citywide GHG levels were 7.3 $MMTCO_2e$ lower than those in the 2005 base year, an overall 12.9 percent reduction.

Municipal operations and facilities GHG emissions were lower in both fiscal and calendar years 2009. Municipal GHG emissions decreased by 0.13 $MMTCO_2e$ from fiscal year 2008 to fiscal year 2009, a 3.5 percent reduction. Total municipal GHG emissions were 0.04 $MMTCO_2e$ lower in fiscal year 2009 than in the fiscal year 2006 base year, a 1.1 percent reduction. Calendar year 2009 municipal GHG emissions were 0.18 $MMTCO_2e$ lower than calendar year 2008 emissions, a 4.8 percent decrease.

This inventory presents updates to past years' base year and interim year inventory results. Such updates allow for comparability of the most recent year's inventory levels with those from past years. In May 2010, version 1.1 of the Local Government Operations Protocol (LGOP) was released by the California Air Resources Board (CARB), The California Climate Action Registry (CCAR), ICLEI – Local Governments for Sustainability (ICLEI), and The Climate Registry (TCR), setting the standards for U.S. local governments to use in completing municipal government GHG inventories.[4] In October 2009, ICLEI released version 1.0 of the International Local Government GHG Emissions Analysis Protocol (IEAP), which provides a general framework for the completion of local government greenhouse gas emissions inventories. The municipal inventory is completed in compliance with the revised LGOP and per the guidance of the IEAP. As no detailed citywide inventory protocol has been promulgated at the time of this report's publication, citywide calculations were made using the LGOP where applicable. Revisions to fuel coefficients published by the U.S. Environmental Protection Agency (EPA) as rules applying to the Mandatory Reporting of Greenhouse Gas Emissions Program (and incorporated into the LGOP) resulted in changes to all fuel coefficients, as well as the electricity and steam emissions coefficients (which are calculated using these fuel coefficients). For the first time, the City calculated the fuel economy of the city's vehicle fleet. As a result of these adjustments, both the citywide and municipal base year inventories decrease, with citywide 2005 base year emissions level decreasing from 58.6 to 56.6 $MMTCO_2e$, a 3.4 percent decrease, and fiscal year 2006 base year GHG emissions decreasing 3.2 percent, from 3.7 to 3.6 $MMTCO_2e$.[5] Tables 4, 5, and 6 on pages 17 and 18 all summarize these changes.

Figure 8: 2008 to 2009 Changes in New York City's Citywide Greenhouse Gas Footprint

New York City's citywide carbon footprint declined 4.2% between 2008 and 2009 due to cleaner imported electricity, reduced energy consumption, and reduced SF_6 emissions

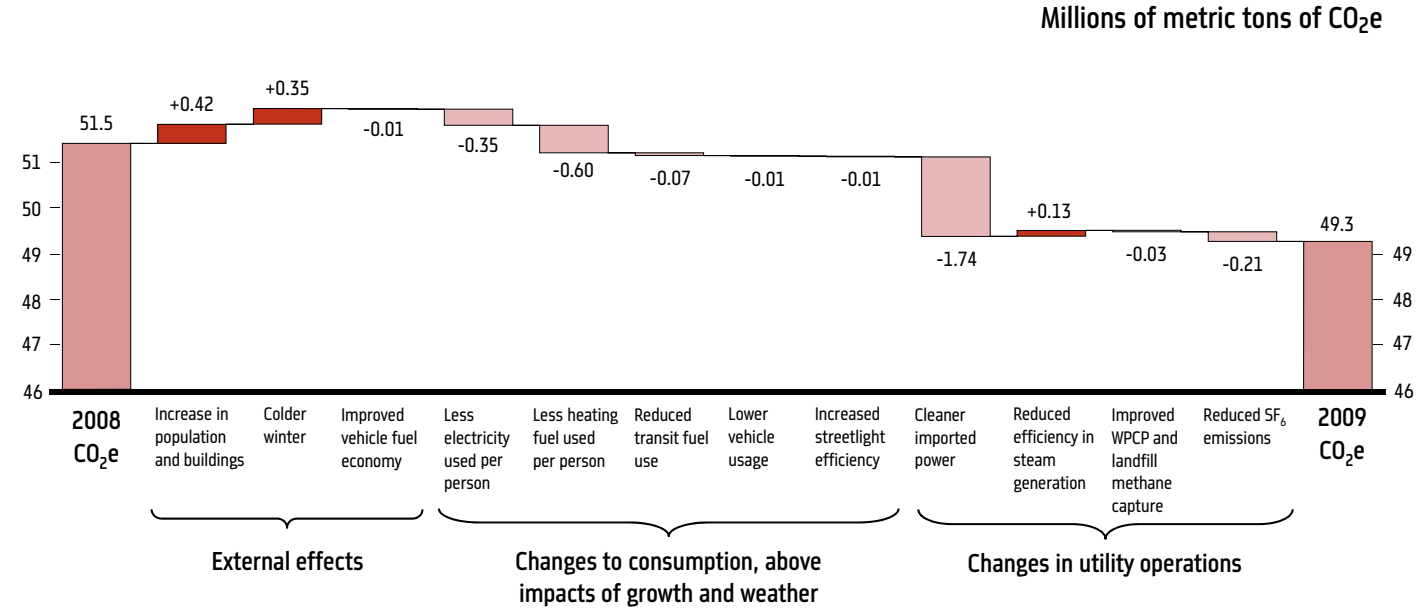


Figure 9: FY 2008 to FY 2009 Changes in New York City's Municipal Government Greenhouse Gas Footprint

New York City's municipal government carbon footprint decreased 3.5% between FY 2008 and FY 2009, due to cleaner imported power, increased streetlight efficiency, reduced heating fuel use, and reduced emissions associated with the transportation of solid waste

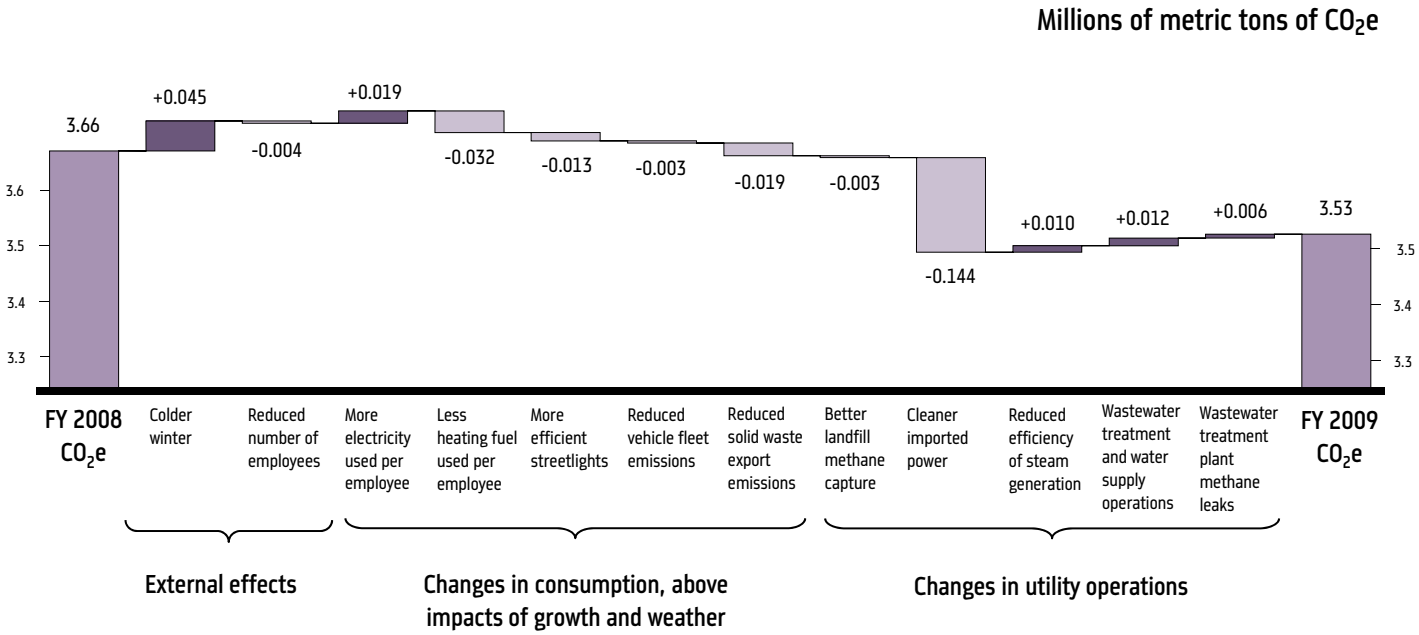


Table 1: 2008 to 2009 Changes in Citywide CO_2e Emissions

	METRIC TONS CO_2e	% of 2008 CO_2e
2008 citywide CO_2e	51,451,929	
Reasons for change		
Increase in population and buildings	419,786	0.82%
Colder winter	346,075	0.67%
Improved on-road vehicle fuel economy	-13,621	-0.03%
Per capita electricity consumption (e.g., electronics)	-354,033	-0.69%
Cleaner, less heating fuel used per person	-599,737	-1.17%
Per capita transit consumption	-73,719	-0.14%
Per capita vehicle usage	-5,837	-0.01%
Increased streetlight efficiency	-13,236	-0.03%
Increase in importation of cleaner power	-1,741,987	-3.39%
Reduced efficiency in steam generation	125,099	0.24%
Improved WPCP and landfill methane capture	-28,420	-0.06%
Reduced fugitive SF_6 from electricity distribution	-210,352	-0.41%
2009 citywide CO_2e total	**49,301,948**	**-4.18%**

Table 2: FY 2008 to FY 2009 Changes in Municipal CO_2e Emissions

	METRIC TONS CO_2e	% OF FY 2008 CO_2e
FY 2008 municipal CO_2e	3,655,710	
Reasons for change		
Colder winter	44,589	1.22%
Reduced number of employees	-3,526	-0.10%
Per employee electricity consumption	18,902	0.52%
Per employee heating fuel consumption	-31,516	-0.86%
More efficient streetlights	-12,573	-0.34%
Reduced vehicle fleet emissions	-3,438	-0.09%
Reduced solid waste export emissions	-19,339	-0.53%
Better landfill methane capture	-3,029	-0.08%
Increase in importation of cleaner power	-143,904	-3.94%
Reduced efficiency of steam generation	9,977	0.27%
Wastewater treatment and water supply operations	11,917	0.33%
Wastewater treatment plant methane leaks	5,811	0.16%
FY 2009 municipal CO_2e total	**3,529,581**	**-3.45%**

Understanding the causes driving changes in GHG emissions is necessary to develop policies to achieve additional carbon reductions. These changes reflect several factors, including: the impact of weather and population growth on energy use; an increase in importantion of less carbon-intensive electricity; new efficient in-city power generation; changes in the amount of methane (CH_4) emitted from the city's wastewater treatment plants and landfills; the impact of more efficient streetlights; and decreased sulfur hexafluoride (SF_6) emissions used for citywide electricity distribution.

Citywide inventory results

Citywide CO_2e emissions are generated from energy used in buildings, transportation, and escaped fugitive emissions from solid waste management, wastewater treatment, and natural gas and electricity distribution. From the adjusted 2005 base year, citywide-CO_2e emissions decreased by 12.9 percent from 56.6 to 49.3 MMT in 2009. Driving this change was a cooler summer, new efficient in-city electricity generation, increased importation of less carbon-intensive electricity, decreased per capita energy consumption, and decreased fugitive SF_6 emissions, which resulted in an overall decrease in CO_2e despite increases in population and building floor area.

From 2008, citywide CO_2e emissions decreased from 51.5 to 49.3 MMT, a 4.2 percent reduction. Several factors contributed to this reduction, including increased importation of less carbon-intensive electricity, less energy used per capita, an increase in importation of cleaner electricity, and additional reduction of fugitive SF_6. These factors allow the City to report an overall reduction in CO_2e levels, despite increases in both population and building floor area. Table 1 summarizes the changes in citywide emissions levels from 2008 to 2009.

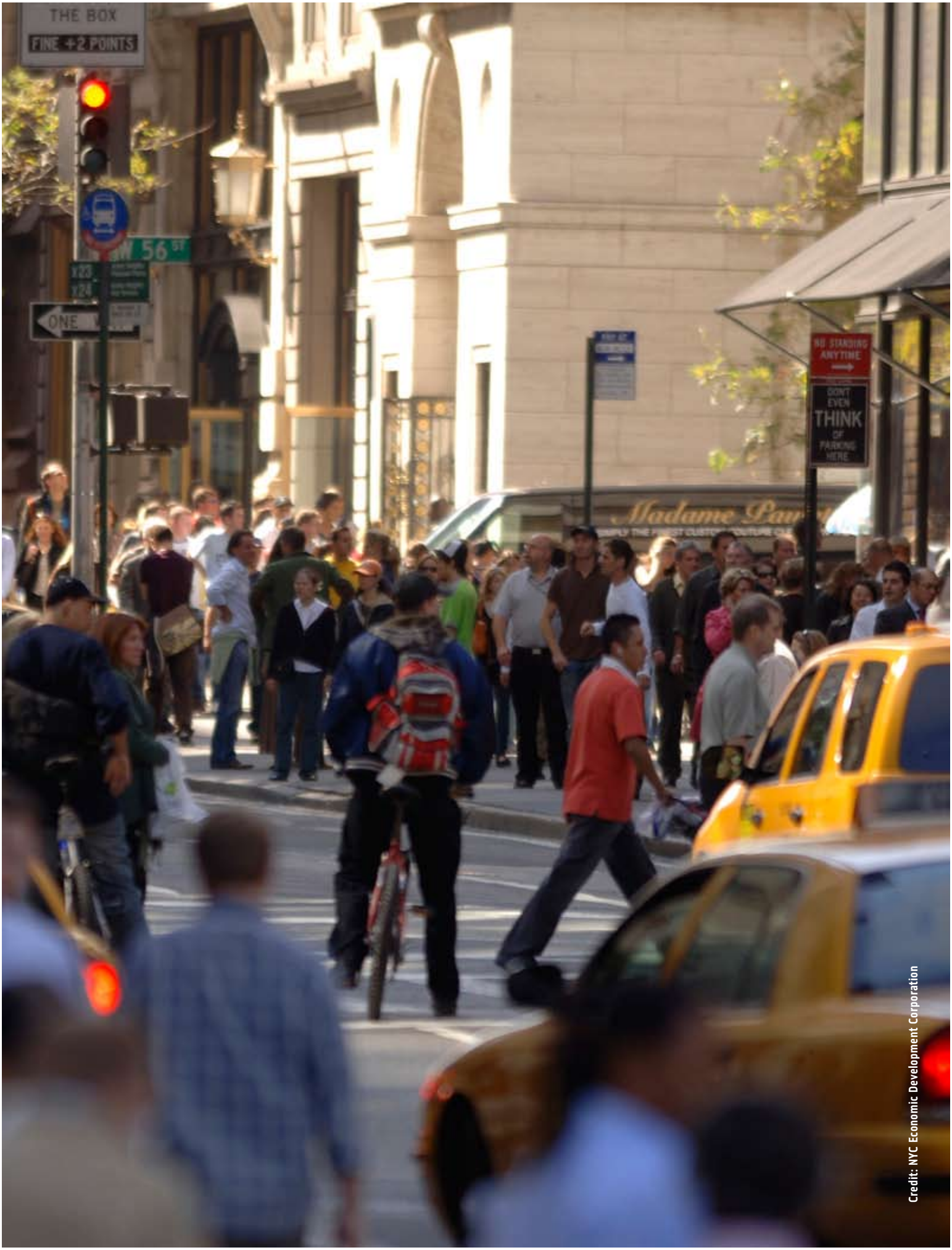
The most significant factors influencing the change in emissions levels from both 2005-2009 and 2008-2009 were changes to the efficiency and generation of New York City's electricity supply. In 2006, two new state-of-the-art power plants came online: New York Power Authority's (NYPA) Astoria Combined Cycle Power Plant and SUEZ Astoria Energy. Together, these plants added 1000 megawatts (MW) of clean energy capacity to New York City's electricity grid, displacing electricity generated from more carbon-intensive power plants. Additionally, a large coal-fired power plant, the Dansakmmer Generating Station in upstate New York, significantly reduced its electricity generation, which resulted in a further reduction of the carbon intensity of electricity imported into the city. This change is responsible for a 3.4 percent reduction in citywide CO_2e from 2008-2009, or approximately 1.74 MMT.

Weather has a significant effect on energy consumption, and its impact varies each year. From 2005 to 2009, average cooler summers reduced CO_2e emissions by 0.7 percent, where from 2008 to 2009, despite a significantly cooler summer, a colder winter resulted in a 0.7 percent CO_2e increase. Changes in heating degree days (HDD) and cooling degree days (CDD), which reflect the demand for energy required to heat or cool a home, business, institution, or industrial facility, are reported in the Appendix.

Municipal operations inventory results

New York City's municipal government provides essential city services to residents, businesses, commuters, and visitors, and given the City government's size, consumes significant amounts of energy while doing so. From fiscal year 2006 to 2009, municipal GHG emissions decreased by 1.1 percent from 3.6 to 3.5 $MMTCO_2e$. This decrease results from reduction in the carbon intensity of the City's electricity supply, a reduction in heating fuel usage, a reduction in fuel used for the transportation of solid waste to final destinations outside the city, and an increase in the efficiency of streetlights and traffic signals. An increase in fugitive methane emissions from wastewater treatment plants as some methane flare equipment continues to undergo repair, increases in energy used for water supply and wastewater treatment, and per employee electricity consumption countered the net impact of these reductions.

Municipal GHG emissions were reduced significantly from fiscal year 2008 to 2009, as the carbon intensity of imported electricity declined citywide, thereby reducing the city's electricity emissions coefficient. Improved efficiency of streetlights and reduced use of fuel for building heat, vehicle fleet, and solid waste transort contributed to this decrease. Figure 9 summarizes the changes in municipal operations from 2008 to 2009.



Credit: NYC Economic Development Corporation

Updates and Revisions

Base and interim year results were revised due to updated emissions coefficients, refined methodology, and improved data availability

The calculation of municipal GHG emissions is a dynamic process that requires new techniques and methods for each year's analysis as new protocols are adopted, methodologies are developed, and improved data become available. To accommodate these changes, the City has revised all base year and interim year GHG emissions levels to reflect changes since the *2009 Inventory* report was published.

Protocol changes

The GHG emissions reported in this inventory are understood to have been calculated using the best data and methodologies available at the time of inventory completion, including all updated emissions coefficients and calculations contained in the May 2010 revision of the LGOP. Incorporation of these updates has resulted in substantial changes to both citywide and municipal base and interim year inventories.

An emissions coefficient is a factor used to calculate the mass of CO_2e that is generated through either the combustion of fossil fuels for energy, or the decomposition of organic matter in solid waste management or wastewater treatment facilities. The U.S. EPA has revised emissions coefficients for all stationary and mobile fuel sources, as reflected in the revised LGOP, and has created new stationary source emissions categories. These changes to the fuel emissions coefficients have been applied to previous year base and interim year inventories, and have also resulted in updates to the base and interim year electricity and steam emissions coefficients.

Refined methodology

The City is constantly striving to improve the accuracy of its GHG emissions reporting. As such, several new methodologies were refined from those used in the *2009 Inventory*, including those applying changes to the LGOP.

Fuel emissions coefficients

The principal methodology revision was to fuel emission coefficients. Developing and applying accurate emissions coefficients is critical to ensure the most accurate GHG emissions reporting possible. The U.S. EPA published revised fuel emissions coefficients as rules applying to the Mandatory Reporting of Greenhouse Gas Emissions Program, which were adopted by the LGOP.[6] Additionally, separate stationary source fuel emissions coefficients were published for the industrial sector, with residential, commercial, and institutional buildings and facilities using the same fuel emissions coefficient. Emissions from #4 fuel oil are now calculated using a separate coefficient, resulting in separate emissions coefficients for #2, #4, and #6 fuel oil (in previous years #2 and #4 fuel oil emissions were calculated using a single coefficient). Additionally, all mobile source on- and off-road fuel coefficients were also revised, as were fuel coefficients used to calculate electricity and steam emissions factors. All new emissions coefficients were applied to past years' base and interim inventories to allow for comparability of results. Updated fuel emissions coefficients and changes from last year's inventory are detailed in Table 3.

Electricity emissions coefficient

As in past years, the City has chosen to develop its own custom electricity emissions coefficient, rather than using the U.S. EPA eGRID coefficient as recommended by the LGOP. 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 is based on data that are several years old—the most recent eGRID coefficient uses 2005 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. Also, the eGRID coefficient does not include imported power— New York City imports a significant volume of electricity from upstate New York, the amount of which increased in 2009, resulting in an increase in the volume of imported electricity generated by less carbon-intensive sources.

Table 3: Summary of Changes to Emissions Coefficients

ENERGY SOURCE	UNIT	COEFFICIENT USED FOR INVENTORY FOR 2008 (LBS CO_2e/UNIT)	FUEL ECONOMY USED FOR INVENTORY FOR 2008 (MILES PER UNIT)	REVISED COEFFICIENT	REVISED FUEL ECONOMY	% CHANGE IN COEFFICIENT	% CHANGE IN FUEL ECONOMY
Stationary source							
#2 Distillate fuel oil (building)**	gallon	22.49386		22.62830		0.60%	
#2 Distillate fuel oil (industrial)	gallon	22.49386		22.57719		0.37%	
#4 Distillate fuel oil (building)**	gallon	22.49386		24.28771		7.97%	
#4 Distillate fuel oil (industrial)	gallon	22.49386		24.23364		7.73%	
#6 Residual fuel oil (building)**	gallon	26.14248		24.97297		-4.47%	
#6 Residual fuel oil (industrial)	gallon	26.14248		24.91741		-4.69%	
Biodiesel (100%)*	gallon	26.14248		20.85317		-20.23%	
Electricity	MWh	774.72421		692.24661		-10.65%	
Kerosene (building)	gallon	21.64530		22.50543		3.97%	
Kerosene (industrial)	gallon	21.64530		22.45543		3.74%	
Natural gas (building)**	therm	11.72771		11.71889		-0.08%	
Natural gas (industrial)	gallon	11.72771		11.70037		-0.23%	
Propane (building)**	gallon	12.74347		12.41380		-2.59%	
Propane (industrial)	gallon	12.74347		12.38010		-2.85%	
Steam	Mlb	158.38337		165.86899		4.73%	
Mobile source							
Biodiesel (100%)	gallon	20.85574		20.86463		0.04%	
CNG - bus	gallon	11.69824	5.58000	12.87204	5.57860	10.03%	-0.03%
Diesel - heavy trucks and buses	gallon	22.39907	6.30000	22.54014	8.79932	0.63%	39.67%
Ethanol (100%)	gallon	13.00529		13.42417		3.22%	
Gasoline - passenger cars	gallon	19.83200	19.14000	19.82523	21.91949	-0.03%	14.52%
Gasoline - light trucks	gallon	19.85496	13.92000	19.87584	16.7199	0.11%	20.11%
Jet fuel	gallon	21.32260		21.32260		0.00%	
Locomotives - diesel fuel	gallon	22.59165		22.72393		0.59%	
Ships and boats - diesel fuel	gallon	22.58887		22.72115		0.59%	

The City used power plant data from U.S. EPA's Continuous Emissions Monitoring System (CEMS) database and the U.S. Energy Information Administration's (EIA) EIA-923 database 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) territory. From these data, New York City's electricity emissions coefficients were calculated by taking the following steps:

1. All electricity generated within New York City (NYISO Zone J) and 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) were added to determine the known quantity of consumption.

2. Emissions coefficients for both in-city generation and bilateral contracts were generated for CO_2, CH_4, N_2O, and CO_2e based on each plant's heat rate (efficiency) and primary fuel used for generation.

3. Imported electricity was calculated by subtracting the combined in-city generation plus bilateral contracts from New York City's required energy, as listed in *NYISO's 2010 Load & Capacity Data "Gold Book."*[7]

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 coefficients, using ConEd's steam system data, to avoid double counting emissions resulting from this generation.

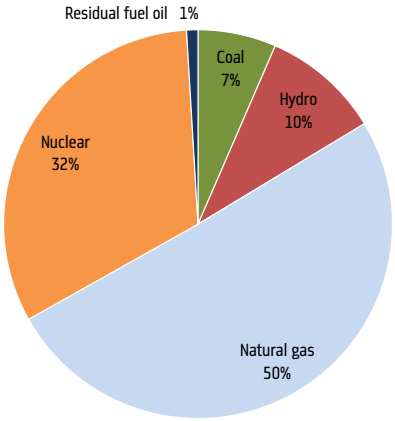
5. The emissions coefficient for imported power was calculated by assigning 600 megawatts (MW) from NYISO Zones A and D and 42 MW of upstate hydropower to New York City per NYPA agreement, with the balance of imported power assumed to be generated in NYISO Zones G, H, and I, as recommended by NYPA.

6. Emissions coefficients for imported power were derived for CO_2, CH_4, N_2O, and CO_2e based on the heat rate of each plant in each zone from which imported power was being generated to develop a single coefficient for each of NYISO Zone A and D, and for NYISO Zone G, H, and I combined.

7. A weighted average coefficient was developed for each GHG, based on the generation of the supplying sector.

8. A transmission and distribution loss factor, calculated by subtracting ConEd and the Long Island Power Authority's (LIPA) reported delivered electricity deliveries from the NYISO energy requirement, was applied to each coefficient. The electricity coefficient is presented in detail in the Appendix.

Figure 10: Electricity Generation Fuel Mix for NYC Consumption



Distillate fuel oil, kerosene, methane, solid waste, solar, wind, and wood account for 0.8% of generation fuel mix.

Table 4: Breakdown of Citywide CO_2e Emissions Changes, 2005 Base to 2005 Adjusted

	METRIC TONS CO_2e	CHANGE AS % OF BASE
2005 reported total CO_2e (*2009 Inventory*)	58,603,657	
Reason for change		
Revised heating fuel coefficients	-40,443	-0.07%
Revised transportation fuel coefficients	32,764	0.06%
Revised on-road fuel economy data	-1,677,605	-2.86%
Revised solid waste export fuel efficiency factors	-123,179	-0.21%
Revised landfill emissions data	-10,033	-0.02%
Revised wastewater treatment plant CH_4 emissions data	48,295	0.08%
Revised electricity coefficient	-153,643	-0.26%
Revised steam coefficient	-71,801	-0.12%
Revised wastewater treatment N_2O data	23,712	0.04%
Revised natural gas distribution fugitive CH_4 data	573	0.00%
2005 adjusted total CO_2e	**56,632,297**	**-3.36%**

Due to market fluctuations in energy fuel prices, in particular the drop in natural gas prices as compared to coal, the carbon intensity of New York City's electricity supply decreased by nearly 10 percent from 2008 to 2009. Almost half of this decrease was due to a large reduction in generation from a coal-fired power generator in NYISO Zone G. The remaining reduction was due to the switching of fuel used in in-city electricity generation from oil to natural gas and increased generation efficiencies.

In 2009, the price of natural gas declined below that of coal, with a significant drop in electricity demand, resulting in coal fired electricity generation for Danskammer Generating Station becoming uneconomical for sale at market prices. In addition, natural gas generation is only economical for power plants whose turbine efficiencies maximize the potential output from each Btu of fuel input. In review of the turbine efficiency data, and in conversation with Danskammer's owners, the City found that Danskammer's turbines do not meet these efficiencies and therefore chose to not produce electricity for a significant amount of time over the course of the year. It is only during summer months with increased electricity demand that coal fired generation and/or lower than average efficient natural gas fired electricity generation become economically viable.

While New York City's electricity emissions coefficient has not been officially verified by a third party, the methodology has been reviewed and endorsed by the U.S. EPA, ConEd, and NYPA. As such, the City encourages all entities in New York City, public and private, to use this coefficient in completing their own GHG inventories. Revised electricity emissions coefficients were applied to past years' inventories and this inventory.

Steam emissions coefficient

As in past inventories, the City developed its own steam emissions coefficient in cooperation with ConEd. A reduction in the percentage of steam generated by co-generation resulted in an increase in the amount of energy required to generate each unit of steam (measured in units of a thousand pounds, or Mlbs). The revised steam coefficient is applied to citywide and municipal 2009 inventories. Past years' steam emissions coefficients were also revised to reflect revised fuel emissions coefficients in the LGOP. The steam emissions coefficient is presented in detail in the Appendix.

It should be noted that the steam emissions coefficient used by New York City is developed in cooperation with ConEd and takes into account the impact of generating a substantial portion of 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 allocates much 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. The City will be working with ConEd to develop a steam emissions coefficient more appropriate for these purposes in the near future.

Impact of weather on energy consumption

In the *2009 Inventory*, the City calculated the impact of weather on energy consumption by completing regression analyses using monthly municipal government energy consumption data and cooling and heating degree days to determine the impact weather has on energy consumption. For this year's analysis, this methodology was amended to more accurately determine this correlation by calculating the expected change in consumption as indicated

Table 5: Breakdown of Municipal CO_2e Emissions Changes, FY 2006 Base to FY 2006 Adjusted

	METRIC TONS CO_2e	CHANGE AS % OF BASE
FY 2006 reported total CO_2e (*2009 Inventory*)	3,687,565	
Reason for change		
Revised electricity coefficient	-2,428	-0.07%
Revised residual fuel coefficient	-10,784	-0.29%
Revised gasoline coefficient and data	-355	-0.01%
Revised distillate fuel coefficient	7,587	0.21%
Revised natural gas coefficient and data	-467	-0.01%
Revised long-haul transport calculation	-122,732	-3.33%
Revised steam coefficient	-3,855	-0.10%
Revised wastewater treatment CH_4 data	-29	0.00%
Revised landfill CH_4 data	-7,649	-0.21%
Revised diesel fuel coefficient	4,595	0.00%
Revised wastewater treatment N_2O	18,485	0.50%
Revised ethanol calculation	263	0.01%
Revised propane coefficient	-178	0.00%
FY 2006 adjusted total CO_2e	**3,570,021**	**-3.19%**

Table 6: Breakdown of Municipal CO_2e Emissions Changes, CY 2008 Base to CY 2008 Adjusted

	METRIC TONS CO_2e	CHANGE AS % OF BASE
CY 2008 reported total CO_2e (*2009 Inventory*)	3,726,731	
Reason for change		
Revised electricity coefficient	-16,083	-0.43%
Revised residual fuel coefficient	-10,936	-0.29%
Revised gasoline coefficient and data	50	0.00%
Revised distillate fuel coefficient	7,390	0.20%
Revised natural gas coefficient and data	-508	-0.01%
Revised long-haul transport calculation	-65,330	-1.75%
Revised steam coefficient	-3,474	-0.09%
Revised wastewater treatment CH_4 data	-9,607	-0.26%
Revised landfill CH_4 data	-4,155	-0.11%
Revised diesel fuel coefficient	2,444	0.07%
Revised wastewater treatment N_2O	21,334	0.57%
Revised ethanol calculation	88	0.00%
Revised kerosene coefficient	9	0.00%
Revised propane coefficient	-194	-0.01%
CY 2008 adjusted total CO_2e	**3,647,759**	**-2.12%**

by the regression analysis and comparing this to the consumption in the earlier year. The resulting weather factor was used in the models that calculated the drivers of changes to emissions for each analysis period. A more detailed explanation is provided in the Appendix.

Building and vehicle fuels for municipal inventory

In the *2009 Inventory*, building and vehicle bulk fuel use was obtained from the Department of Citywide Administrative Services (DCAS), which provided fuel delivery records from fuel vendors. Fuel used for DEP's buildings, facilities, and vehicles was reported separately to allow assignment to either water supply or wastewater treatment (per the LGOP). Vehicle fuel delivered to City vehicles at private fueling stations was provided by the vendor that maintains records of purchases made using the City's GasCard. Revised consumption data for fuel consumption for past years were applied to previous inventories to adjust fuel consumption estimates.

Fuel Economy

For the first time ever, the City has developed custom vehicle fuel economy factors to better reflect the actual fuel economy of vehicles registered in New York City (previous inventories had relied on national average fuel economy factors), resulting in a significant improvement in the fuel economy used for on-road emissions calculations, as emissions from on-road vehicles are calculated using modeled vehicle miles traveled (VMT) data from the New York Metropolitan Transportation Council (NYMTC).

In previous years' inventories, ICLEI's release of the Clean Air and Climate Protection Software (CACPS) provided vehicle fuel economy factors (miles per gallon) used to calculate GHG emissions from on-road transportation sources, including diesel and compressed natural gas (CNG) buses, gasoline passenger cars, gasoline light trucks, and diesel heavy trucks that were reflective of the national average vehicle fleet.

In 2010, the City calculated the fuel economy factor of vehicles registered in New York City in years 2005 to 2010 using vehicle registration data provided by the New York State Department of Motor Vehicles (NYSDMV). This exercise further refines the modeling of on-road transportation emissions for New York City to be more reflective of actual New York City conditions. Additionally, the updated fuel economy factors were applied to past years' mobile source fuel coefficients, the CH_4 and N_2O components of which are calculated using a grams per mile factor. The improved fuel economy resulted in a significant reduction in on-road vehicle emissions for base and interim years.

To calculate specific fuel economies for New York City vehicles, the City conducted the following steps.

1. The City acquired anonymous vehicle registration records of each year, make, model, engine type (i.e. gas-hybrid, gasoline engine, diesel engine, electric vehicle, etc.), category (i.e. taxi, 4-door sedan, convertible, etc.), and borough of registration for all vehicles registered in the city for six years of registration (2005-2010 inclusive).

2. The raw vehicle registration data were used to build a comprehensive database of records, to which was added federal fuel economy factors for almost all years, makes, and models of vehicle registered in New York City. The annual in-city fuel economy numbers, as adjusted by the U.S. EPA, and reported in miles per gallon (MPG) are publicly available at http://www.fueleconomy.gov.

Table 7: Summary of Average Citywide Fuel Economy (Miles Per Gallon)

YEAR	2005	2006	2007	2008	2009
Passenger Cars	22.237	22.345	22.536	21.993	21.919
Light Trucks	16.568	16.705	16.693	16.823	16.720
Heavy Trucks	7.785	8.791	8.301	8.587	8.799
Buses	12.937	12.774	12.707	12.713	12.690

3. The vehicle registration data was matched to the federal fuel economy factors based on year, make, and model, beginning with the most prevalent makes (i.e. Ford, Toyota, Chevrolet, Honda, etc.) and subsequent models. Due to the incomplete matching of registration data to federal fuel economy factors, a small percentage of makes and models were unable to be matched. However, this matching process resulted in the assignment of a fuel economy factor for approximately 90 percent of all NYSDMV records.

4. Once all six years of NYSDMV records were matched to a fuel economy rating, a weighted average fuel economy was determined. This weighted average is categorized by borough, engine type, and vehicle type, although an overall fuel economy number for the entire city is available. Results from 2009 were applied to this year's carbon inventory, while records dating back to 2005 are applied to previous year's base and interim year inventories.

The development of New York City-specific fuel economy factors indicates that vehicles registered in New York City, on average, achieve better fuel economy than the national average. The city passenger vehicle MPG was 21.91 MPG for 2009, while the national average is 19.32 MPG for 2009. This indicates that passenger cars, which represent 89 percent of total vehicle miles driven in New York City, obtain about 13 percent more miles per gallon of gasoline consumed than the average national passenger vehicle.

Moreover, this methodology allows the City to test various policy initiatives to determine the impacts a specific transportation or vehicle fleet-related initiative can have on the city's carbon footprint. The final results for each category and year are detailed in Table 7. It is important to note that this process represents a weighted average of the top 90 percent of all vehicles and types driven in New York City, and does not account for vehicles driven in New York City but registered elsewhere.

Solid waste transport

Revised fuel economy factors were also used to revise the methodology for the calculation of emissions associated with the transportation of solid waste to final destinations outside the city: landfills and waste-to-energy facilities. Previous years' inventories had used fuel efficiency factors from a U.S. Department of Transportation study that estimates that one gallon of diesel fuel moves one (short) ton of solid waste 59 miles by truck and 202 miles by rail.[8] For this year's inventory, revised estimates of 110 ton miles per gallon for trucks and 457 ton miles per gallon for locomotives were used, and were applied to previous years' base and interim year inventories.[9]

Ethanol Content in Gasoline

The LGOP requires that greenhouse gas emissions from biogenic sources be classified as Scope 3 emissions. CO_2 emissions from ethanol are considered biogenic and are therefore counted separately from gasoline, which is a Scope 1 direct emissions source. The State of New York requires that all gasoline contain up to 10 percent ethanol, though the actual percentage varies from about 4 percent to 13 percent.[10] The City obtained inspection records from the New York State Department of Agriculture and Markets for gas stations throughout New York State in 2009. The average ethanol content was applied to both citywide and municipal gasoline consumption data for each year of analysis, thereby allowing for the differentiation of Scope 1 and Scope 3 emissions.

Credit: NYC Department of Transportation

Citywide Inventory

Citywide carbon emissions were 4.2% lower in 2009 than 2008 due to cleaner electricity and improvements in New York City's energy efficiency

Citywide inventory methodology

To most accurately and consistently assess and report citywide carbon emissions, a clear scope of analysis and establishment of boundaries specifying which sources are included in such an assessment are essential. Following standard international convention for the completion of citywide carbon inventories (per the IEAP), the citywide inventory consists of all direct and indirect emissions from energy used by buildings, on-road transportation, and public transit (excluding aviation and marine transportation) within New York City, escaped fugitive emissions from wastewater treatment, solid waste management, and electricity and natural gas distribution within New York City, and emissions associated with solid waste transport outside of the city.

Data sources

Citywide GHG emissions for 2009 were calculated using data from multiple sources. Data on consumption of citywide electricity and steam, and natural gas in the Bronx and Manhattan were provided by ConEd from customer billing data. National Grid reported natural gas consumption data for Brooklyn, Queens, and Staten Island from customer billing data. The Long Island Power Authority (LIPA) reported electricity consumption data for the Rockaways area of Queens using customer billing data. Fuel oil use was estimated using DEP fuel oil boiler permit data, merged with the City property database to estimate the amount of fuel oil burned per square foot of building floor area. On-road transportation vehicle-miles-traveled data were provided by the New York Metropolitan Transportation Council (NYMTC), based on modeling results from the Best Practices Model (BPM) that were post-processed using PPSuite (proprietary software), which incorporates inputs used for air-quality conformity modeling. Energy consumption data for public transit were provided by the Metropolitan Transportation Authority (MTA) for New York City Transit (NYCT) subways and buses, MTA Metro-North Railroad (MNR) and Long Island Rail Road (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. Energy consumption used to calculate GHG emissions included all electricity used for traction and non-traction power (station lighting, etc.) power for NYCT subways and MNR, LIRR, PATH, and NJT commuter rail operated within New York City; all diesel, B5 biodiesel, and compressed natural gas for NYCT, MTA Bus Company, and NJT buses; and diesel fuel consumed within New York City's borders for MNR, LIRR, NJT, and PATH commuter trains.

Data used to calculate fugitive and process CH_4 and process N_2O from wastewater treatment were provided by DEP. CH_4 emissions are calculated based on the destruction of volatile organic 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 wastewater treatment plant to the formula in the LGOP.

Fuel oil consumption calculation for citywide inventory

Citywide fuel oil use was calculated by the DEP for last year's inventory. DEP maintains a database of all permits for fuel oil boilers with capacity equal to or greater than 350,000 British Thermal Units (Btu) per hour. These data were processed using the City's property database to determine the building square footage each fuel oil boiler was responsible for heating, using fuel oil energy intensity factors obtained from the *City Environmental Quality Review* (CEQR) Technical Manual, which estimates that residential space in New York requires 0.38 gallons per square foot of #2 oil and 0.36 gallons per square foot of #4 and #6 oil for heat per year, while commercial space requires 0.36 gallons of #2 oil per square foot and 0.34 gallons of #4 and #6 oil per square foot for heat per year.[11] Number 2 fuel oil use was adjusted to reflect use in boilers less than 350,000 Btu/hour using the U.S. Census Bureau's *2008 New York City Housing and Vacancy Survey*, which estimated that 29 percent of residences using fuel oil for heat are in buildings consisting of less than 15 units, the threshold below which boilers are assumed by industry experts advising the City to have a capacity of less than 350,000 Btu/hour.[12] This additional percentage was added to DEP's reported #2 fuel oil consumption. 2008 fuel oil consumption is assumed to be a baseline—estimated fuel oil consumption for 2009 was calculated based on changes in heating degree days.[13]

Table 8: New York City Citywide Greenhouse Gas Emissions

SECTOR AND EMISSIONS SOURCE	METRIC TONS CO_2e					% CHANGE 2008-2009	% CHANGE 2005-2009
	2005	2006	2007	2008	2009		
Buildings							
Distillate fuel oil	5,327,200	4,527,651	5,297,190	5,182,509	5,356,146	3.35%	0.54%
Electricity	20,434,297	17,950,066	18,074,009	16,884,650	14,898,124	-11.77%	-27.09%
Natural gas	13,032,381	12,550,846	14,170,578	13,704,880	13,651,161	-0.39%	4.75%
Residual fuel oil	2,654,094	2,255,747	2,639,143	2,582,007	2,668,512	3.35%	0.54%
Steam	2,233,406	1,816,893	1,894,386	1,668,095	1,712,283	2.65%	-23.33%
Transportation							
CNG - bus	13,786	13,786	85,205	88,332	85,043	-3.72%	516.89%
Biodiesel B5 - bus				36,184	140,898	289.40%	
Diesel - bus	679,264	679,238	679,238	522,505	360,319	-31.04%	-46.95%
Diesel - commuter rail	14,179	14,431	14,431	14,521	14,066	-3.13%	-0.80%
Diesel - heavy trucks	893,985	792,596	840,244	814,259	799,189	-1.85%	-10.60%
Diesel - solid waste transport, rail	25,962	30,352	32,315	34,610	36,081	4.25%	38.98%
Diesel - solid waste transport, truck	104,587	97,123	85,505	56,235	55,343	-1.59%	-47.08%
Electricity - subways and commuter rail	1,153,424	996,942	1,004,101	1,000,502	915,282	-8.52%	-20.65%
Gasoline - light trucks	769,894	763,572	766,580	763,428	765,070	0.22%	-0.63%
Gasoline - passenger cars	6,696,317	6,664,184	6,629,178	6,817,413	6,820,843	0.05%	1.86%
Streetlights and traffic signals							
Electricity	134,811	118,672	115,135	108,670	85,279	-21.52%	-36.74%
Fugitive and process emissions							
CH_4 - landfills	118,667	115,988	106,114	105,548	102,241	-3.13%	-13.84%
CH_4 - natural gas distribution	12,622	11,200	11,378	11,580	11,354	0.69%	5.53%
CH_4 - wastewater treatment plants	70,056	67,468	72,844	73,420	73,929	-9.88%	65.25%
HFCs - municipal fleet	137,444	259,295	259,295	252,035	227,121	-1.95%	-10.04%
N_2O - wastewater treatment process	88,361	85,294	86,624	85,983	87,276	1.50%	-1.23%
SF_6 - electricity distribution	2,037,561	1,486,813	1,046,696	644,565	436,387	-32.30%	-78.58%
Total Scope 1	**32,676,360**	**30,415,583**	**32,822,558**	**31,790,013**	**31,671,415**	**-0.31%**	**-3.02%**
Total Scope 2	**23,955,937**	**20,882,573**	**21,087,630**	**19,661,917**	**17,630,532**	**-10.43%**	**-26.49%**
TOTAL Scope 1 and 2	**56,632,297**	**51,298,156**	**53,910,188**	**51,451,929**	**49,301,948**	**-4.18%**	**-12.94%**
Scope 3							
Biogenic CO_2 from fuel	524,391	509,295	495,965	500,922	515,616	-1.67%	2.93%
Exported solid waste methane	2,699,120	2,702,362	2,691,282	2,687,027	2,654,098	-1.67%	-1.23%
Aviation emissions	14,345,894	14,146,259	15,733,804	14,343,938	14,179,668	-1.15%	-1.16%
TOTAL Scope 3	**17,569,405**	**17,357,916**	**18,921,051**	**17,531,886**	**17,349,382**	**-1.04%**	**-1.25%**

Fugitive CH_4 from landfills were calculated by applying landfill gas collection data provided by DSNY and DEP to a formula specified in the LGOP. Fugitive CH_4 from natural gas distribution was calculated using volumes of "unaccounted for gas" provided by National Grid and ConEd. Fugitive SF_6 from electricity distribution was calculated by data provided by ConEd.

All DSNY-managed municipal solid waste (residential and institutional solid waste) generated in New York City is transported to landfills or waste-to-energy facilities outside of the city by private contractors under contract to the City. 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 disposal facility by applying Association of American Railroads factors that assume one gallon of diesel fuel moves one (short) ton of solid waste 110 miles by truck and 457 miles by rail.

Fugitive emissions of HFCs from municipal vehicle fleet cooling and refrigeration systems were calculated from data provided by DCAS, which provided the number of regular vehicles and refrigeration vehicles in operation in the City government's vehicle fleet, as well as the type of refrigerant used by each system. The City estimated fugitive refrigerant emissions by applying a default operating emissions factor provided by the LGOP. Municipal fleet vehicles use HFC-134a in cooling systems, while refrigeration vehicles use a refrigerant blend, R404A.

Scope 3 aviation emissions were calculated using fuel consumption data from the PANYNJ. Aviation GHG emissions were calculated by applying the emissions coefficients in the LGOP 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. Scope 3 fugitive emissions generated from the decomposition of solid waste exported out of the city were calculated using waste disposal data from DSNY.

GHG emissions were calculated from all data acquired as described using emissions coefficients in the LGOP. Fuel economy factors for on-road vehicle were calculated as described earlier in the Updates and Revisions section of this report. All emissions coefficients and fuel economy figures are reported in the Appendix.

Figure 11: 2009 Citywide CO_2e Emissions by Sector

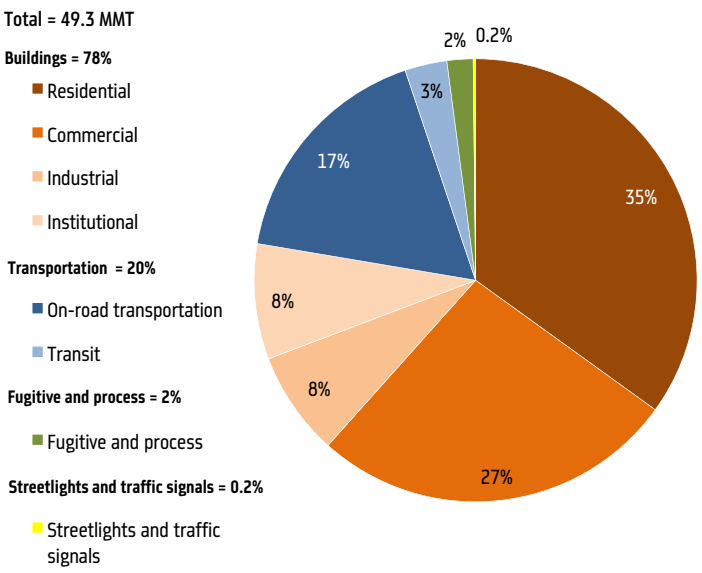


Figure 12: 2009 Citywide CO_2e Emissions by Source

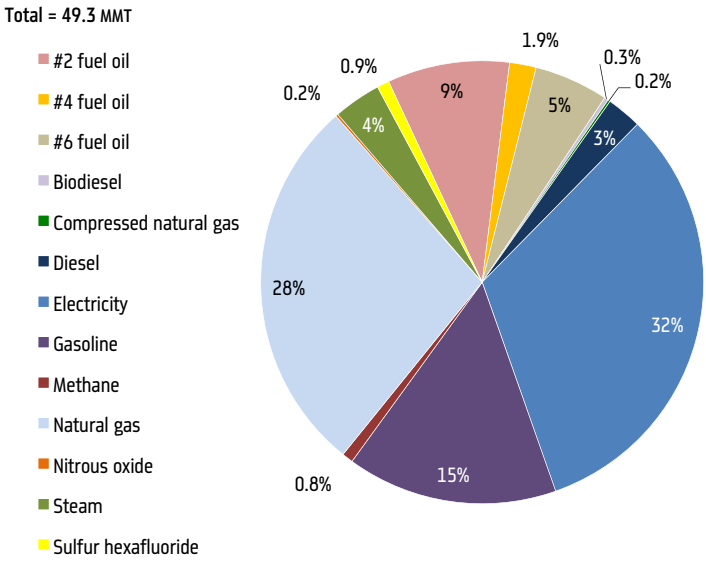


Figure 13: 2005 to 2009 Citywide CO_2e Emissions by Sector

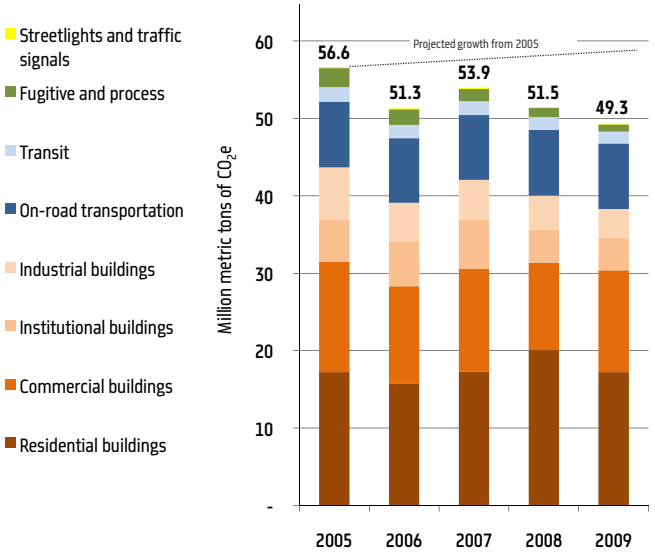
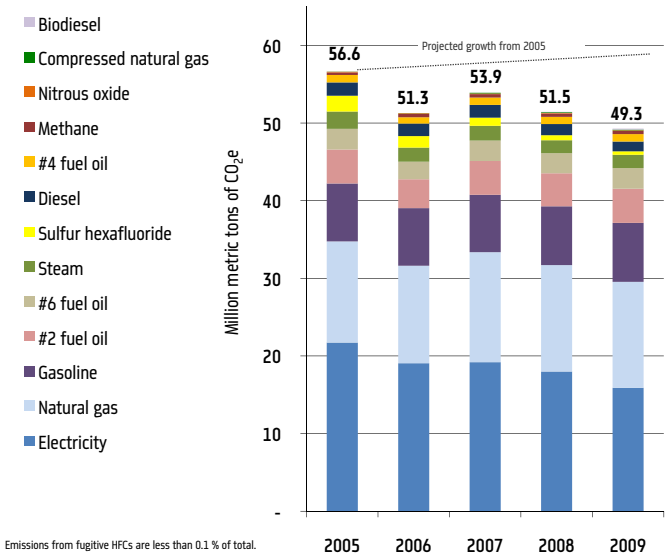


Figure 14: 2005 to 2009 Citywide CO_2e Emissions by Source



Emissions from fugitive HFCs are less than 0.1 % of total.

Citywide inventory results

In 2009, total GHG emissions in New York City were 49.3 $MMTCO_2e$, 12.9 percent below 2005 base year emissions of 56.6$MMTCO_2e$. 2009 GHG emissions are broken down as follows:

- Scope 1 GHG emissions: 31,671,415 $MTCO_2e$
- Scope 2 GHG emissions: 17,630,532 $MTCO_2e$
- Scope 3 GHG emissions (reported for information only): 17,349,382 $MTCO_2e$

2009 citywide GHG emissions were 4.2 percent below 2008 levels of 51.5 $MMTCO_2e$. This significant annual reduction again shows that New York City is on track toward achieving the 30 percent GHG reduction established by *PlaNYC* and mandated by Local Law 22 of 2008. While reporting overall GHG emissions levels indicates progress the City is making toward achieving this requirement, understanding the drivers of these changes is critical to ensuring the most efficient development and implementation of policies necessary to keep the City on track to fulfilling this mandate.

Changes to citywide emissions

To fully understand causes of changes in New York City GHG emissions, the City analyzed all factors that might influence these changes, such as weather, population growth, increase in building floor area, changes to the city's electricity supply, and the impact of revised carbon intensity of fuels. Using these data, the City determined drivers that could be influenced by policy changes, such as per capita energy use or transit consumption. To calculate

Figure 15: 2005 to 2009 Changes to New York City's Greenhouse Gas Footprint

New York City's citywide carbon footprint declined 12.9% between 2005 and 2009 due to milder weather, reduced energy consumption, cleaner imported electricity, and reduced SF_6 emissions

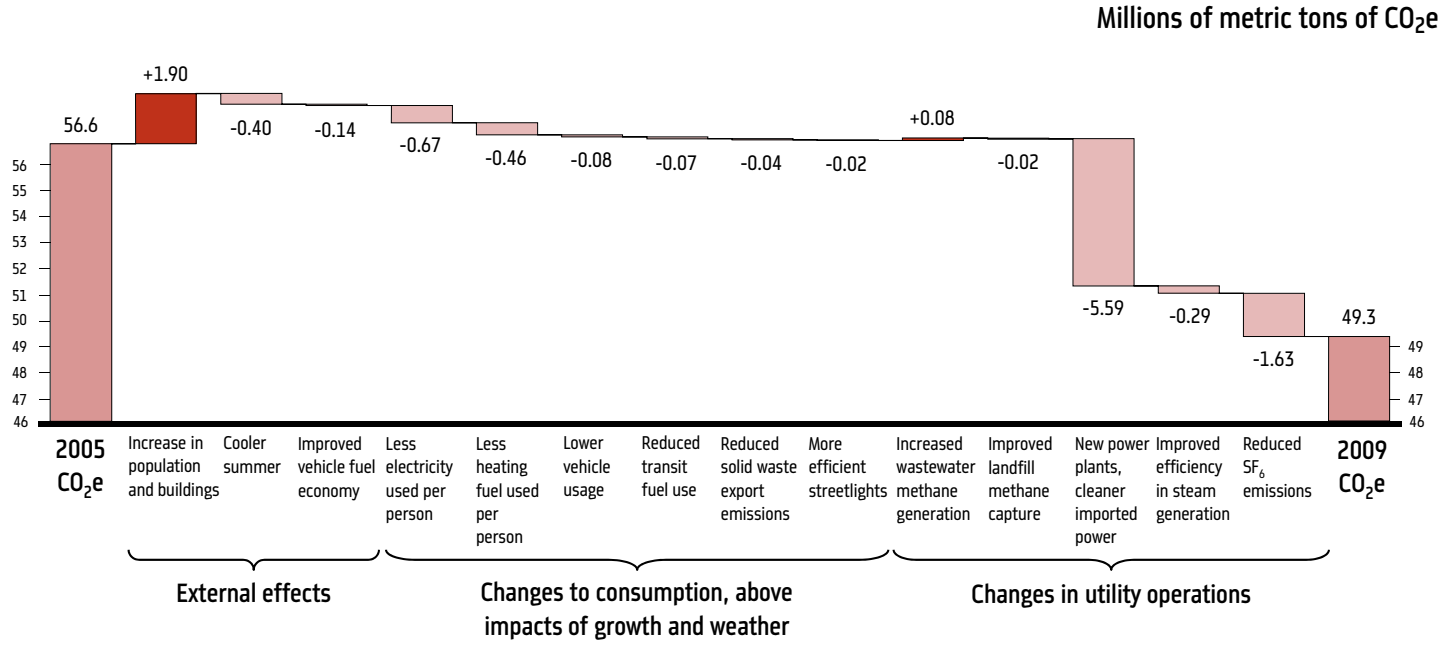


Table 9: 2005 to 2009 Changes in Citywide CO_2e Emissions

	METRIC TONS CO_2e	% OF 2005 CO_2e
2005 citywide CO_2e	56,632,297	
Reasons for change		
Increase in population and buildings	1,901,663	3.36%
Cooler summer in 2009 than 2005	-404,693	-0.71%
Improved on-road vehicle fuel economy	-44,880	-0.08%
Per capita electricity consumption (e.g., electronics)	-666,147	-1.18%
Per capita natural gas/heating oil consumption	-455,394	-0.80%
Per capita vehicle usage	-83,313	-0.15%
Per capita transit consumption	-70,366	-0.12%
Per capita solid waste transport	-41,378	-0.07%
More efficient streetlights	-17,171	-0.03%
Increase in wastewater treatment plant methane	84,725	0.15%
Improved landfill methane capture	-18,458	-0.03%
New, more efficient electricity generation; increase in importation of cleaner power	-5,586,335	-9.86%
Improved efficiency in steam generation	-293,716	-0.52%
Reduced fugitive SF_6 from electricity distribution	-1,634,884	-2.89%
2009 citywide CO_2e total	49,301,948	-12.94%

Table 10: 2009 Citywide Emissions by Scope and GHG

SCOPE	GREENHOUSE GAS (METRIC TONS)					
	CO_2	CH_4	N_2O	HFCs	SF_6	CO_2e
Scope 1	30,435,604	22,328	1,030	9	18	31,671,415
Scope 2	17,595,942	335	91			17,630,532
Scopes 1 and 2	48,031,546	22,663	1,121	9	18	49,301,948

the impact of these drivers, the City first compared the changes in CO_2e emissions and consumption of each energy source from each sector. The percentage of population change was applied to all non-building emission sources, while the percentage change in building floor area was applied to building emissions sources to determine the collective net impact these drivers had on GHG emissions. To determine the impact of energy consumption beyond that driven by changes in weather, the City conducted regression analyses for each building energy source, using monthly energy consumption data and heating degree and cooling degree data to determine the correlation between weather and building energy use. The results of this analysis were used to determine the expected consumption of electricity, fuel oil, natural gas, and steam for each year, which were divided by the energy consumption of each energy source in the earlier year for each period to determine a weather impact factor. This factor was then multiplied by the consumption for each building energy source to determine the impact weather had on the consumption of building energy use. The results of regression analyses for electricity, natural gas, steam, and fuel oil are shown in the Appendix.

Per capita trends were determined by subtracting the percentage of overall population change, the weather impact factor, and the change in carbon intensity from the change in GHG emissions for each energy source in each sector. The impact of revisions to various coefficients was determined by calculating the change in carbon intensity for each energy source in each sector, and multiplying this factor times the percentage that each energy source in each sector contributed to the inventory total.

Figure 16: 2009 Citywide CO_2e Building Emissions by Sector

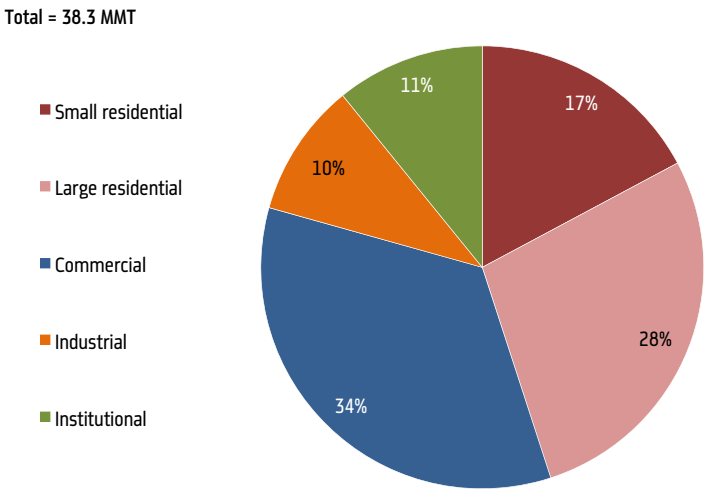


Figure 17: 2009 Citywide CO_2e Building Emissions by Source

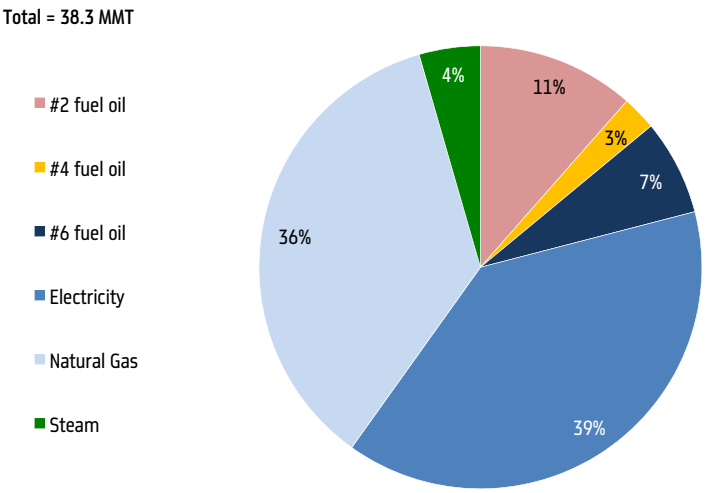


Figure 18: 2009 Citywide CO_2e Transportation Emissions by Mode

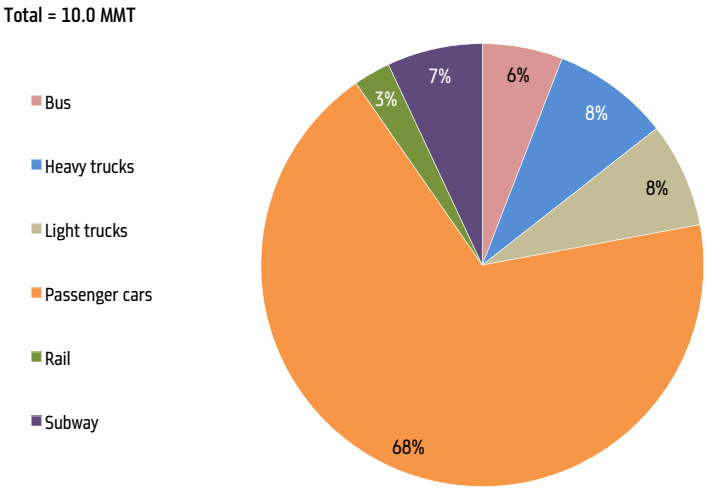
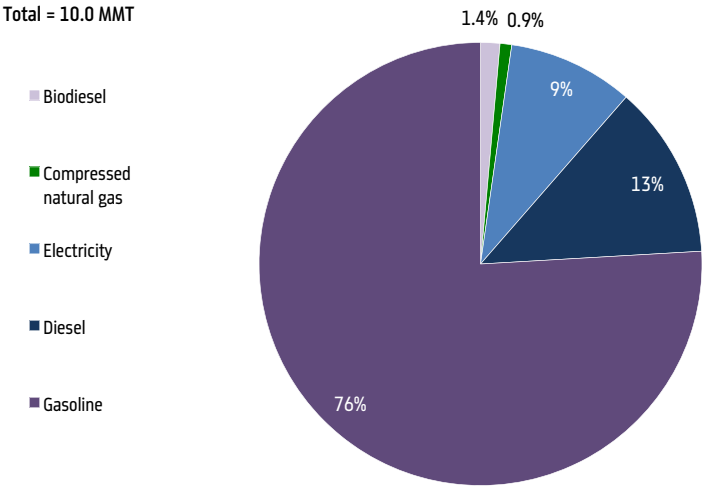


Figure 19: 2009 Citywide CO_2e Transportation Emissions by Source



Changes from 2005 to 2009

When all factors influencing the change in New York City's citywide GHG emissions from 2005 to 2009 are analyzed, cooler summer temperatures, reductions in per capita energy use, changes to the carbon intensity of the city's electricity supply, and a reduction in fugitive SF_6 from electricity distribution are most responsible for reducing the city's GHG emissions by 12.9 percent. These reductions were offset by growth in both population and building square footage. When weather, growth, fuel economy, and changes to the carbon intensity of the electricity and steam supply are excluded, citywide carbon emissions decreased by 5.1 percent.

Changes from 2008 to 2009

Citywide GHG emissions decreased by 4.2 percent from 2008 to 2009 driven by an increase in generation of cleaner electricity, reduced per capita energy use, and a decrease in fugitive SF_6 emissions from electricity distribution. These three major reductions were most tempered by growth in population and building floor square footage and colder weather. When weather, growth, fuel economy, and changes to the carbon intensity of the electricity and steam supply are excluded, citywide carbon emissions decreased by 2.5 percent. Perhaps the most signifcant change is seen in reductions in per capita electricity and heating fuel use, showing that New York City as a whole is becoming more energy-efficient. Details of these changes are presented in Table 1 and Figure 8 on pages 12 and 13.

Credit: NYC Department of Environmental Protection

Municipal Inventory

Municipal government carbon emissions were 3.5% lower in FY 2008 than FY 2009 due to reduced carbon intensity of electricity and less heating fuel use

Municipal Inventory Methodology

For both fiscal and calendar year 2009, the City followed the LGOP's guidance in measuring GHG emissions based on operational control, measuring emissions from operations, facilities, or sources wholly owned by the City government or over which the City has full authority to introduce and implement operational and health, safety, and environmental policies (including both GHG- and non-GHG-related policies).[14] Emissions from leased vehicles and facilities were also included. The operation of New York City's government, which ensures the provision of services to the city's residents, businesses, commuters, and visitors, requires a substantial amount of energy. In fiscal year 2009, the majority of emissions, 73 percent, resulted from the operation of municipal buildings, facilities, and the municipal vehicle fleet. Other significant sources of greenhouse gas emissions resulting from City operations include streetlights and traffic signals, the water supply system, wastewater treatment facilities, landfills, and the transport of solid waste to destinations outside the city.

All data used to calculate municipal GHG emissions were acquired from either City agencies or fuel vendors. Metered data provided by utilities is maintained by DCAS, which provided comprehensive electricity, natural gas, and steam consumption data for the City's buildings, facilities, and streetlights. Building and facility heating fuel consumption data were provided by vendors who provide fuel to the City and by DEP. Vehicle fuel use data were provided by the City's fuel vendors and for both bulk fuel purchases and vehicle fuel purchased using the City's GasCard. Calculation of GHG emissions from both building and vehicle bulk fuel considers fuel volume delivered as an estimate of fuel volume consumed. Efforts are currently underway to implement a comprehensive fuel tracking system, allowing future inventories to more accurately measure GHG emissions from bulk fuel consumption.

Data used to calculate fugitive and process emissions were provided by several agencies: data used to calculate fugitive and process CH_4 and N_2O emissions from wastewater treatment were provided by DEP, fugitive CH_4 from the City's landfills was calculated from data provided by DEP and DSNY, fugitive hydrofluorocarbons (HFCs) from municipal vehicle fleet cooling and refrigeration systems were calculated from data provided by DCAS, and emissions from the long-haul transport of solid waste were calculated from data provided by DSNY. All calculations were made as described above in the citywide inventory methodology section.

As required by the LGOP, the municipal inventory also reports emissions associated with employee commuting as a required Scope 3 source. Employee commuting emissions were estimated using the U.S. Census Bureau's Public-Use Microdata Sample dataset, which indicated the means of transportation to work for City employees.[15] For passenger car trips, distance traveled to work was estimated using employees reported time of commute, applying an average road network speed of 15 miles per hour. The resultant vehicle miles traveled (VMT) was used to calculate CO_2e. Subway and bus emissions were estimated using MTA NYCT ridership statistics and total CO_2e emissions from these sources to develop an average per person share of CO_2e. This per person share was applied to the total number of work trips for City employees, calculated by multiplying the number of employees by twice the number of work days per year (238).

Emissions from the decomposition of solid waste generated by City employees are also consider a Scope 3 source. These emissions were calculated by multiplying the number of employees by the amount of solid waste estimated to be generated by each employee annually, as calculated by DSNY. The composition of waste generated by office workers was determined from DSNY's Waste Characterization Study, while the composition of waste generated by uniformed employees was taken from CACPS 2009.[16]

Table 11: New York City Municipal Greenhouse Gas Emissions

SECTOR AND EMISSIONS SOURCE	METRIC TONS CO_2e				% CHANGE FY 2008 - 2009	% CHANGE FY 2006 - 2009	METRIC TONS CO_2e		% CHANGE CY 2008 - 2009
	FY 2006	FY 2007	FY 2008	FY 2009			CY 2008	CY 2009	
Buildings									
Distillate fuel oil	236,948	252,454	232,036	238,388	2.74%	0.61%	234,593	223,014	-4.94%
Electricity	1,167,724	1,194,845	1,147,562	1,037,785	-9.57%	-11.13%	1,148,565	1,031,540	-10.19%
Natural gas	551,614	574,842	571,827	589,541	3.10%	6.88%	545,434	575,965	5.60%
Residual fuel oil	230,267	212,597	231,683	234,372	1.16%	1.78%	233,515	237,870	1.86%
Steam	128,398	138,192	133,040	143,391	7.78%	11.68%	130,527	140,354	7.53%
Streetlights and traffic signals									
Electricity	115,824	112,280	105,980	83,147	-21.54%	-28.21%	106,219	83,149	-21.72%
Wastewater treatment									
Distillate fuel oil	45,668	50,524	49,967	49,042	-1.85%	7.39%	46,128	51,531	11.71%
Electricity	222,343	220,893	209,157	198,663	-5.02%	-10.65%	211,095	205,909	-2.46%
Methane	148,426	194,772	245,974	251,785	2.36%	69.64%	252,035	227,121	-9.88%
Natural gas	19,515	30,024	38,955	41,314	6.06%	111.71%	37,949	35,020	-7.72%
Nitrous oxide	83,134	85,808	87,790	89,138	1.54%	7.22%	85,983	87,276	1.50%
Propane		3	5	-	-100.00%		3	-	-100.00%
Steam	200	240	352	378	7.50%	89.22%	346	224	-35.28%
Water supply									
Distillate fuel oil	1,427	1,579	2,388	1,960	-17.92%	37.36%	2,201	2,202	0.03%
Electricity	23,499	24,025	23,756	20,696	-12.88%	-11.93%	23,225	20,719	-10.79%
Kerosene	-	161	216	175	-19.08%		248	131	-47.46%
Natural gas	2,666	2,705	3,436	3,654	6.34%	37.04%	3,789	3,807	0.50%
Propane	6,063	6,580	7,313	7,660	4.74%	26.33%	6,618	7,314	10.52%
Steam	263	283	310	332	7.28%	26.20%	297	378	27.40%
Transportation									
Diesel and biodiesel - trucks	156,185	158,602	159,270	157,459	-1.14%	0.82%	171,788	164,933	-3.99%
Diesel - marine vessels	43,956	44,820	46,192	48,231	4.42%	9.73%	44,663	44,875	0.48%
Diesel - solid waste transport, rail	28,157	32,547	32,083	34,445	7.36%	22.33%	32,315	36,081	11.65%
Diesel - solid waste transport, truck	100,863	93,376	77,624	55,924	-27.96%	-44.56%	85,502	55,343	-35.27%
Ethanol (E85)	281	189	175	160	-8.39%	-43.14%	216	142	-34.10%
Gasoline	123,534	129,792	129,105	125,936	-2.45%	-2.97%	125,170	121,939	-2.58%
Jet fuel	2,197	2,533	2,256	2,104	-6.74%	-4.20%	2,209	2,076	-6.01%
Solid waste facilities									
Methane	119,499	110,542	105,576	102,548	-2.87%	-14.19%	105,548	102,241	-3.13%
Other fugitive and process emissions									
HFCs from municipal vehicle fleet	11,370	11,563	11,685	11,354	-2.83%	-0.13%	11,580	11,354	-1.95%
Total Scope 1	**1,911,770**	**1,996,171**	**2,035,554**	**2,045,189**	**0.47%**	**6.98%**	**2,027,486**	**1,990,238**	**-1.84%**
Total Scope 2	**1,658,251**	**1,690,758**	**1,620,156**	**1,484,393**	**-8.38%**	**-10.48%**	**1,620,274**	**1,482,274**	**-8.52%**
Total Scope 1 and 2	**3,570,021**	**3,686,929**	**3,655,710**	**3,529,581**	**-3.45%**	**-1.13%**	**3,647,759**	**3,472,512**	**-4.80%**
Scope 3									
Biogenic CO_2e from fuel	224,207	223,248	237,830	228,868	-3.77%	2.08%	234,365	230,774	-1.53%
Employee commute	13,625	13,746	20,940	15,239	-27.23%	11.84%	22,445	20,238	-9.83%
Employee solid waste	174,178	176,400	179,015	177,192	-1.02%	1.73%	176,856	178,741	1.07%
Total Scope 3	**412,010**	**413,394**	**437,785**	**421,298**	**-3.77%**	**2.25%**	**433,666**	**429,753**	**-0.90%**

Municipal Inventory Results

Fiscal year 2009 results

In fiscal year 2009, the operation of New York City's government resulted in the emission of 3.5 $MMTCO_2e$, 1.1 percent below fiscal year 2006 levels. These emissions are broken down by scopes as follows:

- Scope 1 GHG emissions: 2,045,189 $MTCO_2e$
- Scope 2 GHG emissions: 1,484,393 $MTCO_2e$
- Scope 3 GHG emissions (reported for information only): 421,298 $MTCO_2e$

As with citywide emissions, to allow the City to understand reasons for changes in GHG emissions reflected by this inventory beyond those governed by external effects such as weather and emissions coefficients, the City analyzed all changes in municipal GHG emissions for fiscal year 2006 to 2009 and fiscal year 2008 to 2009.

Changes to municipal emissions

Changes to GHG emissions were measured similarly to those measured for citywide GHG emissions, as changes to CO_2e levels and energy consumption were calculated for each energy source in each sector. External effects of changes in population (number of City employees) and weather (correlated to energy use), as well as the carbon intensity of each energy source were subtracted from the percentage change in total GHG emissions to determine the per capita trend for each energy source in each sector, while the change in carbon intensity due to coefficient revisions was calculated by dividing the reduction in CO_2e by the change in consumption for each energy source in each sector. Each of these factors was used to determine the change in CO_2e emissions, factoring in weather, the change in number of City employees, the per capita trend, and the coefficient change, where applicable. The percentage of the total change was then calculated for each category of change analyzed.

Figure 20: FY 2009 Municipal CO_2e Emissions by Sector

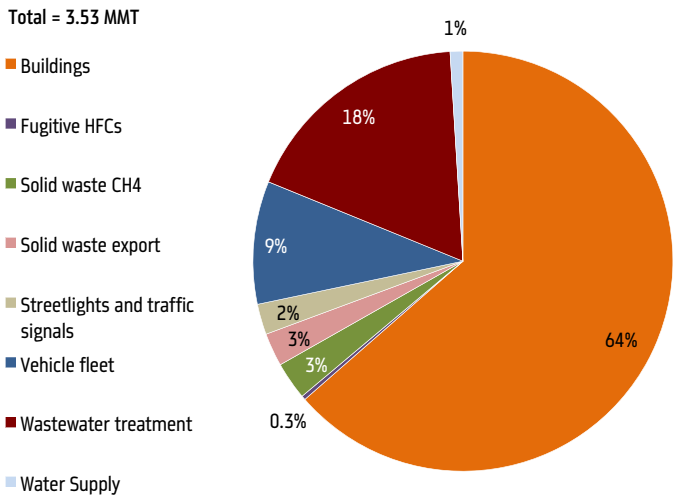


Figure 21: FY 2009 Municipal CO_2e Emissions by Source

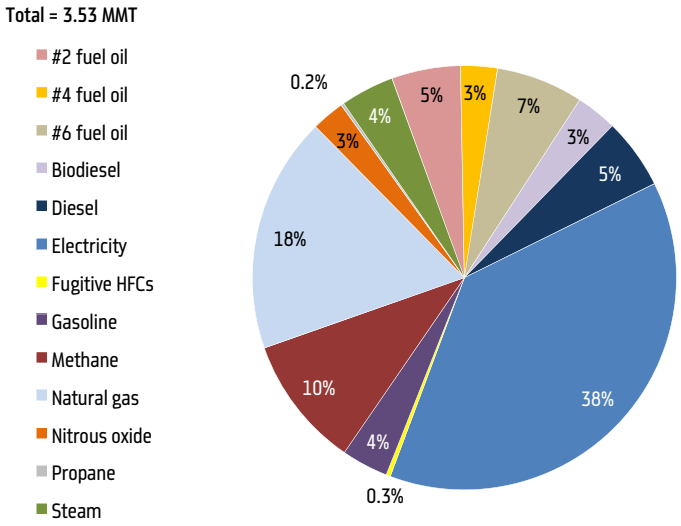


Figure 22: FY 2005 to 2009 Municipal CO_2e Emissions by Sector

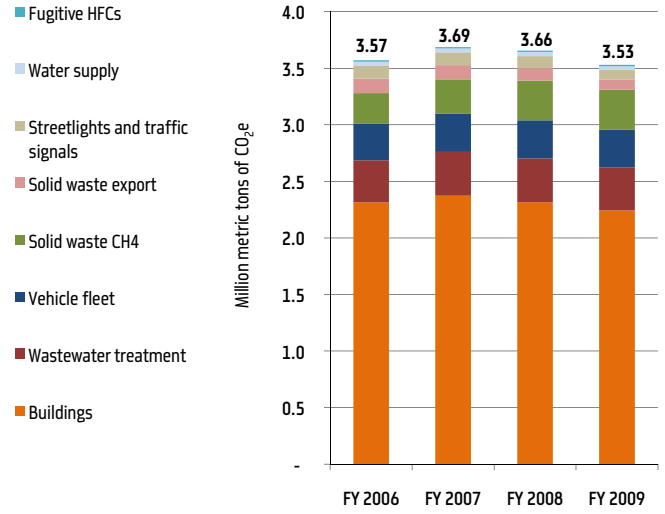
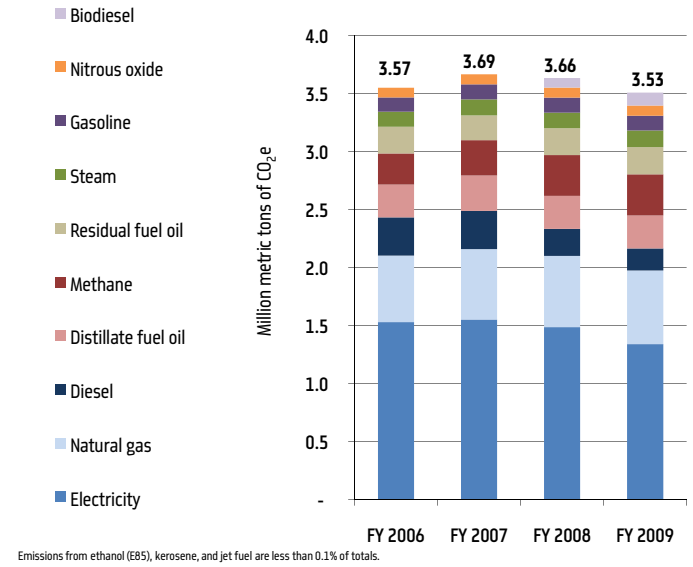


Figure 23: FY 2005 to 2009 Municipal CO_2e Emissions by Sector



Emissions from ethanol (E85), kerosene, and jet fuel are less than 0.1% of totals.

Municipal Fiscal Year 2006 to 2009 changes

Municipal GHG emissions decreased from fiscal years 2006 to 2009 by 1.1 percent, from 3.57 to 3.53 $MMTCO_2e$. The principal factors leading to this decrease in municipal CO_2e emissions from fiscal years 2006 to 2009 were a reduction in the carbon intensity of the city's electricity supply, reduced heating fuel use per employee, more efficiency streetlights and traffic signals, and improved efficiency in solid waste transportation as the mode of transport has continued to transition from truck to rail as part of the City's Solid Waste Management Plan. An increase in the number of City employees, an increase in heating carbon intensity, more electricity used per employee, increased wastewater treatment and water supply operations emissions, and wastewater treatment plant methane leaks (due to flare equipment undergoing repair), all contributed to temper emissions reductions. When external effects of weather and the carbon intensity of the city's electricity and steam supply are excluded, emissions are shown to have increased 2.1 percent over this period. Details of these changes are reported in Table 2.

Municipal Fiscal Year 2008 to 2009 changes

Municipal GHG emissions decreased by 3.5 percent from fiscal year 2008 to 2009, from 3.66 to 3.53 $MMTCO_2e$. The principal reasons for this decrease were a reduction in the carbon intensity of the city's power supply, the continued transition from truck to rail for exporting solid waste, increased streetlight efficiency, and a reduction in per employee building heating fuel use. When weather, the carbon intensity of the city's electricity and steam supply, and the number of City employees, municipal carbon emissions decreased by 0.9 percent over this period. Details of these changes are reported in Table 11.

Figure 24: FY 2008 to FY 2009 Changes in New York City's Municipal Greenhouse Gas Footprint

New York City's municipal government carbon footprint decreased 1.1% between FY 2006 and FY 2009, due to more efficient power plants, cleaner imported power, more efficient streetlights, less heating fuel use, and reduced solid waste export emissions

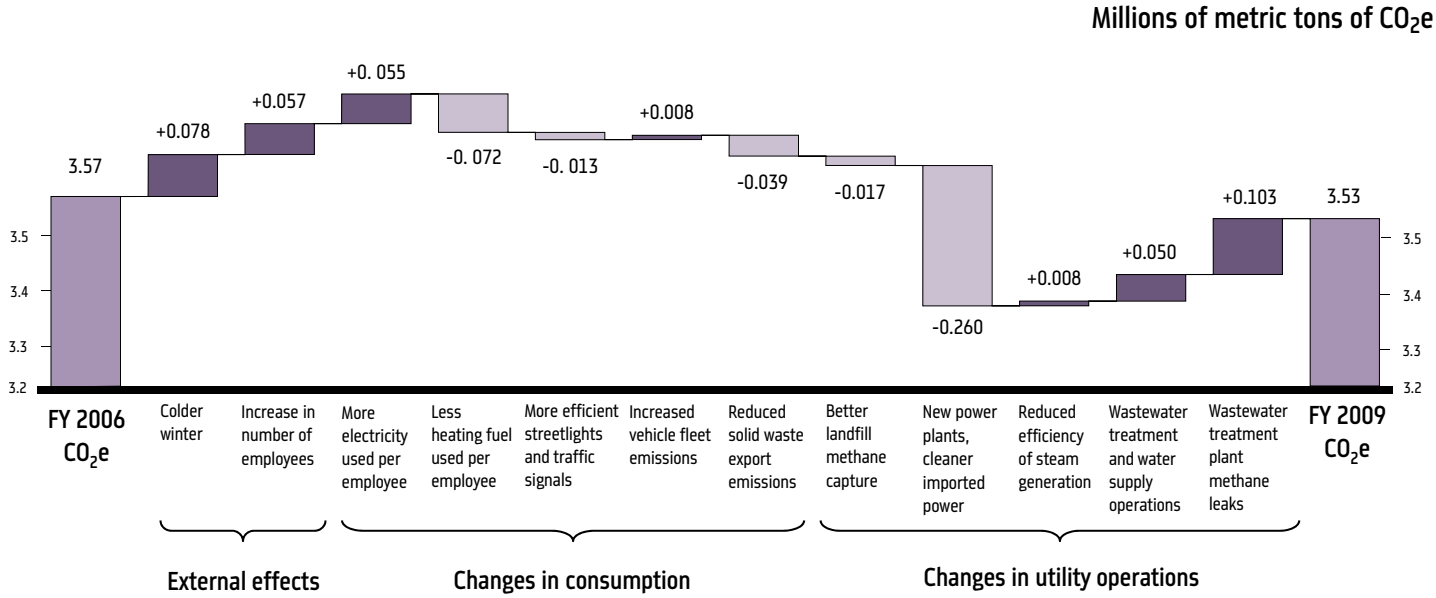


Table 12: FY 2006 to FY 2009 Changes in Municipal CO_2e Emissions

	METRIC TONS CO_2e	% OF FY 2008 CO_2e
FY 2006 municipal CO_2e	**3,570,021**	
Reasons for change		
Colder winter	77,873	2.18%
Increased number of employees	57,179	1.60%
Per employee electricity consumption	55,185	1.55%
Per employee heating fuel consumption	-71,534	-2.00%
More efficient streetlights and traffic signals	-13,014	-0.36%
Increased vehicle fleet emissions	7,722	0.22%
Reduced solid waste export emissions	-38,652	-1.08%
Better landfill methane capture	-16,951	-0.47%
New power plants, cleaner imported power	-259,650	-7.27%
Reduced efficiency of steam generation	8,071	0.23%
Wastewater treatment and water supply operations	49,971	1.40%
Wastewater treatment plant methane leaks	103,359	2.90%
FY 2009 municipal CO_2e total	**3,529,581**	**-1.13%**

Table 13: CY 2008 to CY 2009 Changes in Municipal CO_2e Emissions

	METRIC TONS CO_2e	% OF CY 2008 CO_2e
CY 2008 municipal CO_2e	3,647,759	
Reasons for change		
Colder winter	13,823	0.38%
Reduced number of employees	-35,126	-0.96%
Per employee electricity consumption	22,564	0.62%
Per employee heating fuel consumption	16,251	0.45%
More efficient streetlights	-12,787	-0.35%
Reduced vehicle fleet emissions	-10,305	-0.24%
Reduced solid waste export emissions	-26,393	-0.72%
Better landfill methane capture	-3,307	-0.09%
New power plants, cleaner imported power	-144,161	-3.95%
Reduced efficiency of steam generation	9,789	0.27%
Wastewater treatment and water supply operations	19,316	0.53%
Wastewater treatment plant methane leaks	-24,913	-0.68%
CY 2009 municipal CO_2e total	**3,472,512**	**-4.76%**

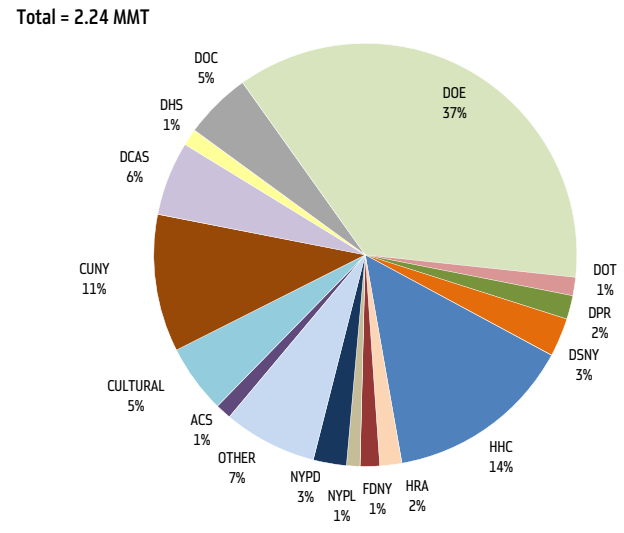
Table 14: FY 2009 Municipal Emissions by Scope and GHG

SCOPE	GREENHOUSE GAS (METRIC TONS)				
	CO_2	CH_4	N_2O	HFCs	CO_2e
Scope 1	1,581,356	17,012	307	9	**2,045,189**
Scope 2	1,481,480	28	7		**1,484,393**
Scopes 1 and 2	**3,062,836**	**17,040**	**315**	**9**	**3,529,581**

Table 15: CY 2009 Municipal Emissions by Scope and GHG

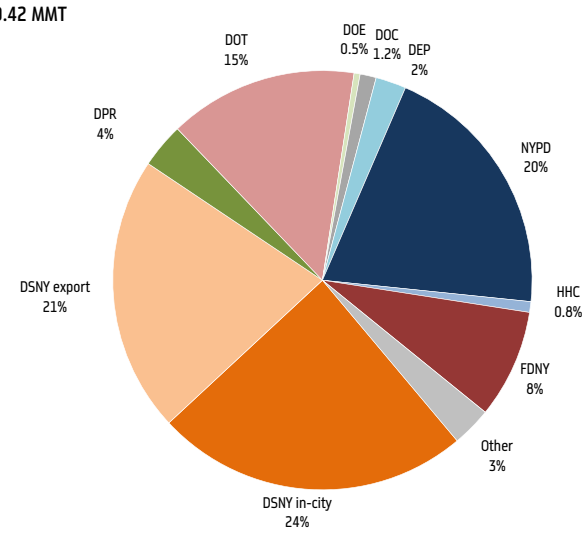
SCOPE	GREENHOUSE GAS (METRIC TONS)				
	CO_2	CH_4	N_2O	HFCs	CO_2e
Scope 1	1,553,311	15,820	301	9	**1,990,238**
Scope 2	1,479,366	28	7		**1,482,274**
Scopes 1 and 2	**3,032,678**	**15,848**	**309**	**9**	**3,472,512**

Figure 25: FY 2009 Municipal Buildings CO_2e Emissions by Agency



Does not include DEP emissions. A list of agency acronyms is in the Appendix.

Figure 26: FY 2009 Municipal Vehicle CO_2e Emissions by Agency



Includes DSNY solid waste transportation outside of city. A list of agency acronyms is in the Appendix.

Figure 27: FY 2009 Municipal Buildings CO_2e Emissions by Source

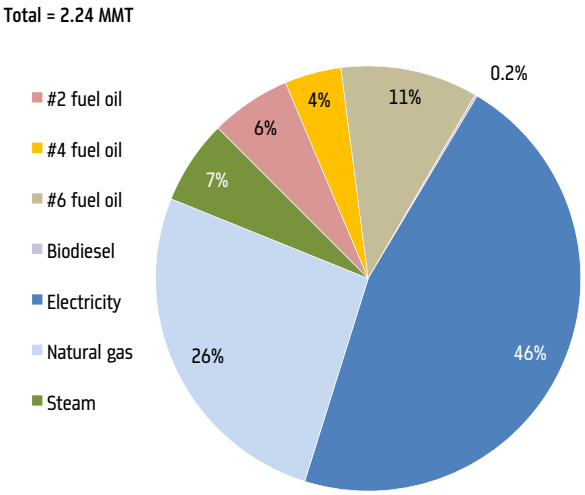
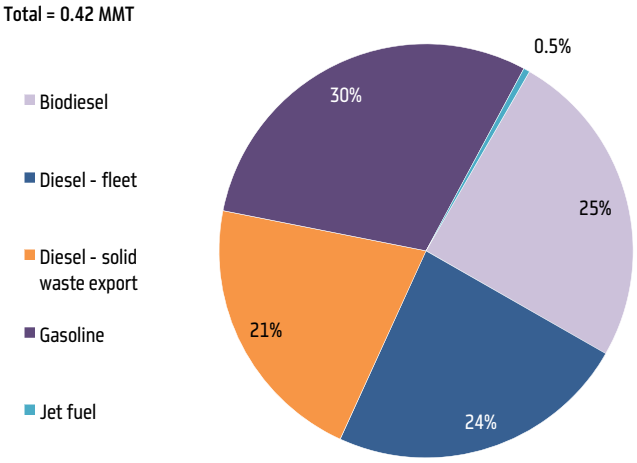


Figure 28: FY 2009 Municipal Vehicle CO_2e Emissions by Source



Emissions from ethanol (E85) are less than 0.1% of sector total

Municipal Calendar Year 2009 results

Per the LGOP, the City reports emissions from City operations and facilities on a calendar year basis, as well as by fiscal year in compliance with Local Law 22 of 2008. In calendar year 2009, municipal operations and facilities were responsible for the emission of 3.5 $MMTCO_2e$. The breakdown of calendar year 2009 GHG emissions by scope is as follows:

- Scope 1 GHG emissions: 1,990,238 $MTCO_2e$
- Scope 2 GHG emissions: 1,482,274 $MTCO_2e$
- Scope 3 GHG emissions (reported for information only): 429,753 $MTCO_2e$

Municipal Calendar Year 2008 to 2009 Changes

This inventory is the first annual update of municipal government greenhouse gas emissions measured during a calendar year period. Municipal GHG emissions decreased by 4.8 percent from CY 2008 to 2009, dropping from 3.65 to 3.47 $MMTCO_2e$. As shown in other periods of analysis in this report, the principal drivers of this change are a reduction in the carbon intensity of the city's electricity supply, increased streetlight efficiency, and increased efficiency of solid waste transport, with a reduction in the number of City employees, reduced vehicle fleet emissions, and reduced wastewater treatment plant methane leaks all contributing to this reduction. When factors beyond the control of the City are excluded, however, emissions decreased by 0.5 percent. Changes to municipal greenhouse gas emissions from CY 2008-2009 are detailed in Table 13.

Figure 29: FY 2009 Municipal Wastewater CO_2e Emissions by Source

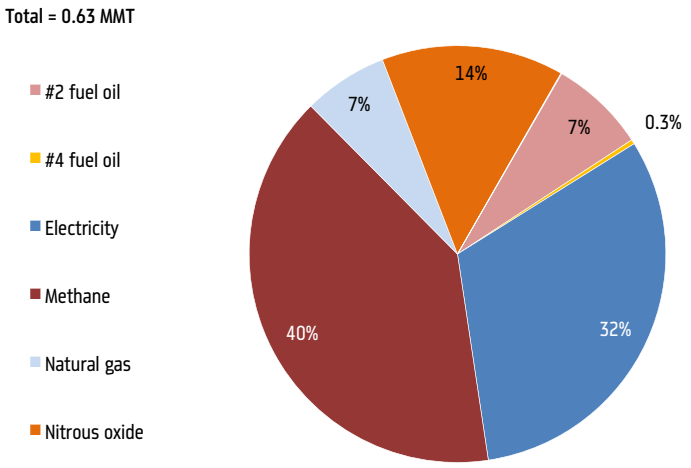


Figure 30: FY 2009 Municipal Water Supply CO_2e Emissions by Source

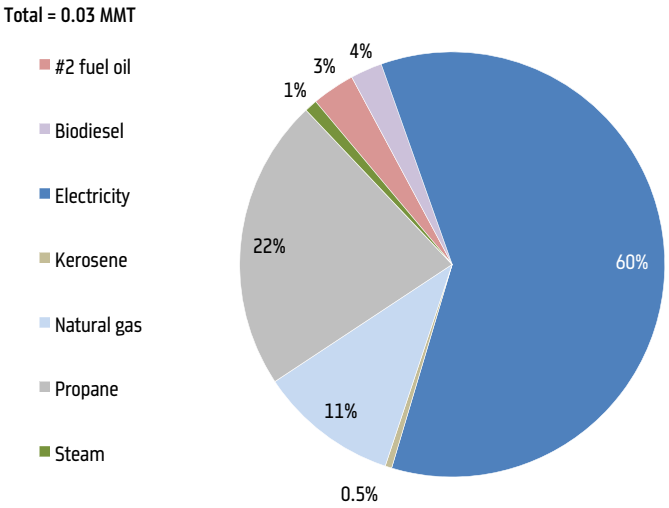


Figure 31: FY 2009 New York City CO_2e Emissions from Transport of Solid Waste Outside the City

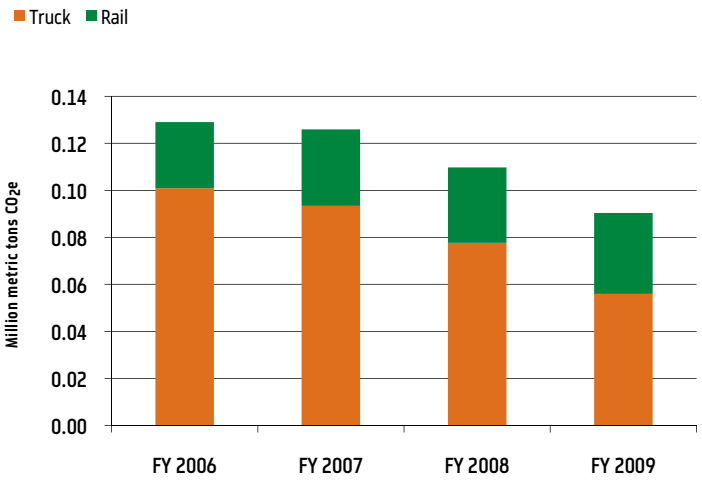
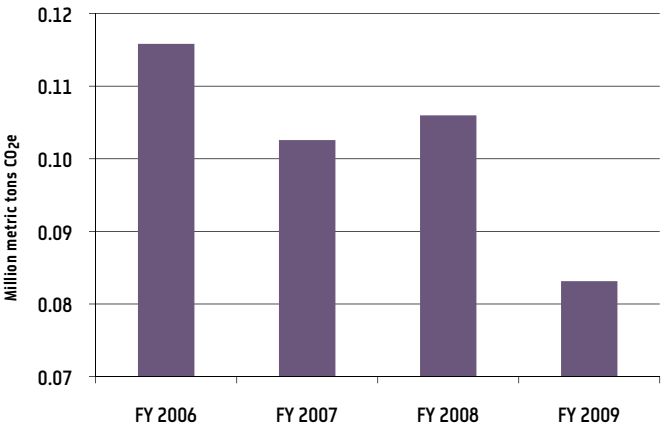


Figure 32: FY 2009 New York City CO_2e Emissions from Streetlights and Traffic Signals



Conclusion

As reported each year, this updated greenhouse gas inventory provides the most comprehensive and current information on the sources, levels, and trends of New York City citywide and municipal government greenhouse gas emissions possible. Additionally, it identifies the impact that drivers of change such as weather, population, policy decisions, infrastructure investments, and consumer behavior have on carbon emissions levels.

Citywide greenhouse gas emissions decreased by 4.2 percent from 2008, again showing that the City is on track to achieve *PlaNYC*'s goal of a 30 percent reduction in citywide carbon emissions below 2005 levels by 2030. This decrease, despite continued growth in population and the city's building stock, highlights the benefits of reduced energy consumption by the city's residents, workers, and visitors and also demonstrates the emissions reductions achieved through less carbon-intensive electricity generation.

Municipal government emissions decreased by 3.5 percent below fiscal year 2008 levels, and 4.8 percent below calendar year 2008 levels, demonstrating that the City is now on track to achieve its goal of a 30 percent reduction in municipal greenhouse gas emissions below fiscal year 2006 by 2017 and highlighting the impact of reduced energy consumption by the City's employees due to energy efficiency measures.

This inventory was completed using the most current protocols, methodologies, and data available. As it has each year, the City has attempted to develop the most accurate and useful assessment of carbon emissions possible. Consistent with this practice, future inventory efforts will incorporate changes to analysis techniques as appropriate. The City will continue to collaborate with other cities around the world to develop uniform accounting, analysis, and reporting methodologies to allow for the most useful comparability of municipal carbon emissions.

The information compiled, calculated, and analyzed in the generation of this inventory is extremely valuable information and continues to inform the City's policy decisions. However, additional opportunities exist for more in-depth analysis, which will proceed over the course of the next year.

Credit: NYC Economic Development Corporation

APPENDICES

Acronym Definitions

New York City Agencies:

ACS - New York City Administration for Children's Services
DCAS - New York City Department of Citywide Administrative Services
DOC - New York City Department of Correction
DEP - New York City Department of Environmental Protection
DHS - New York City Department of Homeless Services
DOT - New York City Department of Transportation
DPR - New York City Department of Parks and Recreation
DOE - New York City Department of Education
DSNY - New York City Department of Sanitation
FDNY - New York City Fire Department
HPD - New York City Department of Housing Preservation and Development
HRA - New York City Human Resources Administration
NYPD - New York City Police Department
OMB - New York City Office of Management and Budget

Other Entities:

CARB - California Air Resources Board
CCAR - California Climate Action Registry
ConEd - Con Edison of New York
CULTURAL - Cultural institutions
CUNY - City University of New York
EIA - United States Energy Information Administration
EPA - United States Environmental Protection Agency
HHC - New York City Health and Hospitals Corporation
ICLEI - ICLEI-Local Governments for Sustainability
LIPA - Long Island Power Authority
LIRR - Long Island Rail Road
MTA - Metropolitan Transportation Authority
MNR - Metro-North Railroad
NJT - New Jersey Transit
NOAA - National Oceanic and Atmospheric Administration
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
PATH - Port Authority Trans-Hudson Corporation
TCR - The Climate Registry
WBCSD - World Business Council for Sustainable Development
WRI - World Resources Institute

The following acronyms are used throughout this report:

Btu - British thermal units
BPM - Best Practices Model
CACPS - Clean Air and Climate Protection software
CDD - cooling degree days
CEMS - Continuous Emissions Monitoring System
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
FY - fiscal year
GHG - greenhouse gas
GIS - geographic information systems
HDD - heating degree days
HFCs - hydrofluorocarbons
kWh - kilowatt hour
LGOP - Local Government Operations Protocol
MMBTU - million British thermal units
$MMTCO_2e$ - million metric tons of carbon dioxide equivalent
MT - metric ton
$MTCO_2e$ - metric tons of carbon dioxide equivalent
MW - megawatts
MWh - megawatt hour
N_2O - nitrous oxide
SF_6 - sulfur hexafluoride
SWMP - Solid Waste Management Plan
VMT - vehicle miles traveled

Endnotes

1. City of New York, *Inventory of New York City Greenhouse Gas Emissions* (April 2007), available online at http://www.nyc.gov/html/planyc2030/downloads/pdf/emissions_inventory.pdf.
2. 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.
3. 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.
4. 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 (2010), available online at http://www.theclimateregistry.org/downloads/2010/05/2010-05-06-LGO-1.1.pdf.
5. Carbon dioxide equivalent is a common unit of reporting that allow greenhouse gases with different impacts on global climate change to be added together as reported as one comprehensive unit. Following standard international convention and the LGOP, this report uses global warming potentials reported in the Intergovernmental Panel on Climate Change's Second Assessment Report (SAR), 1996.
6. U.S. Environmental Protection Agency, Final Mandatory Reporting of Greenhouse Gases Rule, available online at http://www.epa.gov/climatechange/emissions/downloads09/GHG-MRR-FinalRule.pdf.
7. New York Independent System Operator (April 2010), Table I-4a: Historic Energy Requirements and Coincident Peaks, available online at http://www.nyiso.com/public/webdocs/services/planning/planning_data_reference_documents/2010_GoldBook_Public_Final_033110.pdf.
8. U.S. Department of Transportation Maritime Administration, *Environmental Advantages of Inland Barge Transportation*, August 1994, available at http://ntl.bts.gov/lib/6000/6300/6301/837.pdf.
9. Association of American Railroads, *2009 Railroad Facts Book*, p. 40.
10. New York State Department of Agriculture and Markets.
11. Available online at http://www.nyc.gov/html/oec/downloads/pdf/CEQR_Technical_Manual_Appendices.pdf.
12. U.S. Census Bureau, *2008 New York City Housing and Vacancy Survey* (2009), Table 42. Available online at http://www.census.gov/hhes/www/housing/nychvs/2008/nychvs08.html.
13. The correlation of weather to heating fuel oil use was calculated using municipal fuel oil records. The regression analysis graph used for this calculation is in the Appendix.
14. LGOP Version 1.1 (May 2010), pp 14.
15. U.S. Census Bureau, available online at http://www.census.gov/main/www/pums.html.
16. New York City Department of Sanitation, *2004-2005 NYC Residential and Street Basket Waste Characterization Study*, available online at http://www.nyc.gov/test/nycwasteless/html/resources/wcs_results.shtml#finalreport.

City Comparison Data Sources

Greenhouse Gas Emissions and Electricity Consumption Data Per Capita Comparisons

Austin: http://www.coolaustin.org/downloads/ACPP_Annual_Report_5.20.09_FINAL.pdf
Baltimore: http://cleanergreenerbaltimore.org/uploads/files/Full%20GHG%20Inventory%20Report%202007%2010.7.09.pdf
Boston: http://www.cityofboston.gov/climate/pdfs/Report2005GHGinventory.pdf
Copenhagen: http://www.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/CitizenInformation/~/media/4FAFC7144E3141D8984401D494CC5021.ashx
Chicago: http://www.chicagoclimateaction.org/filebin/pdf/finalreport/CCAPREPORTFINALv2.pdf
Dallas: http://www.greendallas.net/pdfs/GHG_Emissions_Summary.pdf
Denver: http://www.greenprintdenver.org/docs/Denver_GHG_Inventory_Report.pdf
Hong Kong: http://www.epd.gov.hk/epd/english/climate_change/files/GHG_Inventory_Table_1990_2007.pdf
Houston: http://www.nrs.fs.fed.us/pubs/jrnl/2009/nrs_2009_na_001.pdf
London: http://legacy.london.gov.uk/mayor/priorities/docs/delivering_london_energy_future_assembly_and_functional_body_draft_february_2010.pdf
Los Angeles: http://www.ladwp.com/ladwp/cms/ladwp000509.jsp
Madrid: http://www.c40cities.org/docs/ccap-madrid-110909.pdf
Miami: http://www.miamigov.com/msi/pages/Climate%20Action/MiPlan%20Final%20062608.pdf
Philadelphia: http://www.phila.gov/green/
Portland: http://www.portlandonline.com/bps/index.cfm?c=49989&a=268612
San Diego: http://www.sandiego.gov/environmental-services/sustainable/pdf/action_plan_07_05.pdf
San Francisco: http://www.sfenvironment.org/downloads/library/climateactionplan.pdf
Seattle: http://www.seattle.gov/climate/docs/2008-community-inventory-fullreport.pdf
Singapore: http://app.mewr.gov.sg/web/Contents/Contents.aspx?ContId=1233
Stockholm: http://international.stockholm.se/-/News-from-the-City-of-Stockholm/News/Action-plan-for-climate-and-energy/
Sydney: http://www.cityofsydney.nsw.gov.au/Environment/GreenhouseAndAirQuality/WhattheCityisdoing/CarbonNeutral.asp
Tokyo: http://www2.kankyo.metro.tokyo.jp/pdf/B/tokyo_strategy_full.pdf
Toronto: http://www.toronto.ca/teo/pdf/ghg-aq-inventory-june2007.pdf
USA: http://www.epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_Report.pdf
Vancouver: http://vancouver.ca/sustainability/documents/2008GHGInventoryMethodologiesDocument20091210.pdf
Washington D.C.: http://green.dc.gov/green/lib/green/2010_1_12__ghgemissionsinventoryreport.pdf

Transportation Comparisons

U.S. Census Bureau, 2008 American Community Survey

Weather Impacts on Emissions

In *PlaNYC*, the City estimated that more than 40 percent of all energy consumed within the city's buildings was used to heat or cool building spaces. As 75 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 consumption 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) consumption 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 consumption 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.)

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

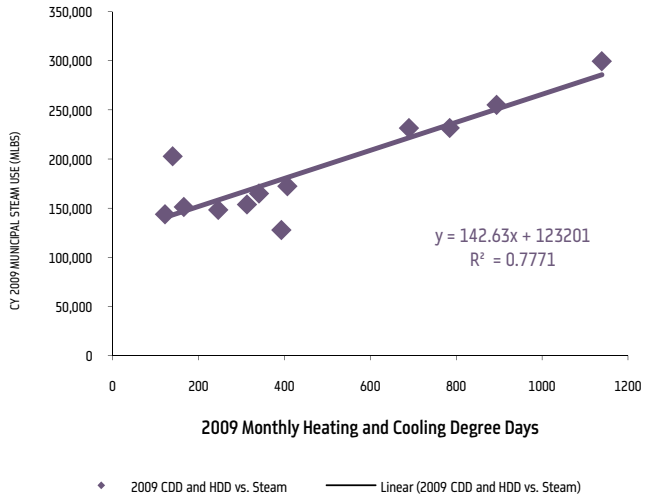


Figure 33: Correlation of Cooling Degree Days to Electricity Use

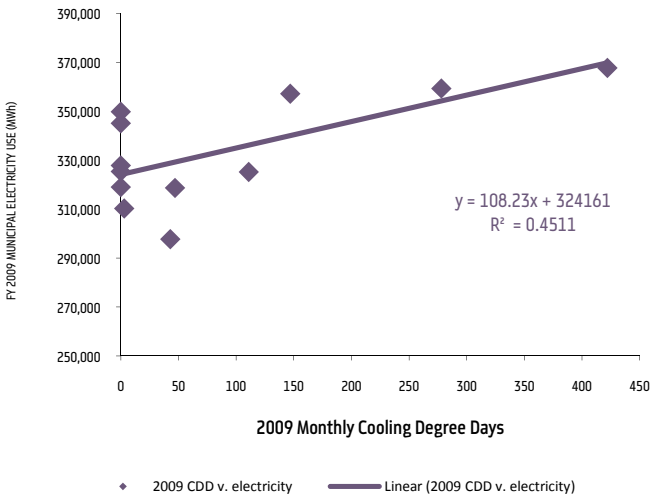


Figure 34: Correlation of Heating Degree Days to Natural Gas Use

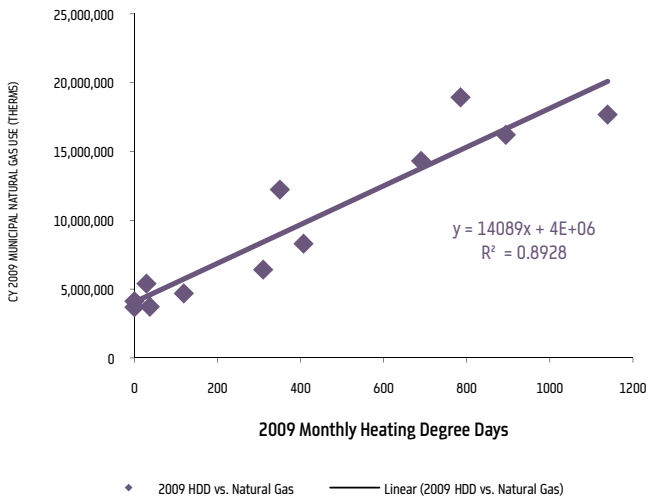
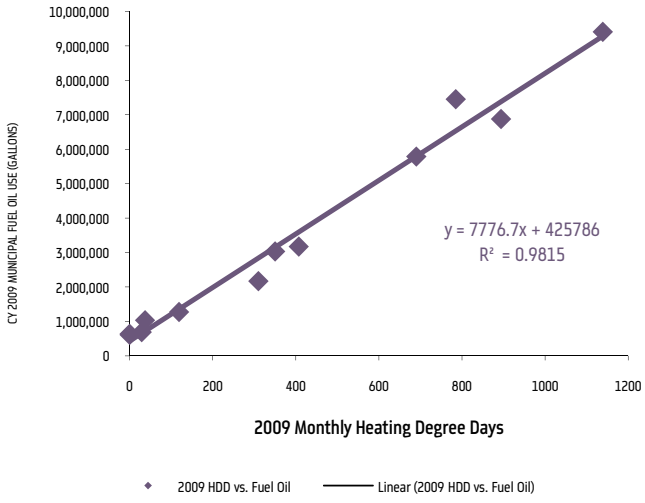


Figure 35: Correlation of Heating Degree Days to Fuel Oil Use



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

Steam Emissions Coefficients

2005 Steam Emissions Coefficient

To convert metered lbs of steam to Btu		Steam Fuel Breakdown & Emissions Coefficients						Steam Coefficient per MMBTU Delivered to Buildings divided by fuel mix percentage			
Lbs of steam generated per lb of steam delivered (1/0.85)	1.1718		CO_2 (lbs/ MMBTU)	CH_4 (lbs/ MMBTU)	N_2O (lbs/ MMBTU)	CO_2e (lbs/ MMBTU)	% of mix	CO_2 (lbs/ MMBTU)	CH_4 (lbs/ MMBTU)	N_2O (lbs/ MMBTU)	CO_2e (lbs/ MMBTU)
Steam Generation Efficiency	103.5%	Residual fuel Oil	165.57	0.0066	0.0013	166.1161	54.09%	89.5600	0.0036	0.0007	89.8570
Difference between delivery and generation	113.2%	Natural gas	116.89	0.0022	0.0002	117.0037	45.88%	53.6321	0.0010	0.0001	53.6847
Steam Btu/lb at generation	1193	Kerosene	165.79	0.0066	0.0013	166.3366	0.02%	0.0402	0.0000	0.0000	0.0403
Water Btu	18	Average	448.2439	0.0154	0.0029	449.4564	100.0%	**143.2323**	**0.0046**	**0.0008**	**143.5820**
Net Btu/lb	1175							Steam Coefficient per Mlb Delivered to Buildings			
Total Btu input/lb steam	**1330.15**							CO_2 (lbs/Mlb)	CH_4 (lbs/Mlb)	N_2O (lbs/Mlb)	CO_2e (lbs/Mlb)
								190.5205	**0.0061**	**0.0011**	**190.9856**

2006 STEAM EMISSIONS COEFFICIENT

			Steam Coefficient per Mlb Delivered to Buildings	CO_2	CH_4	N_2O	CO_2e
Steam Generation Efficiency	124.6%						
Total Btu input/lb steam	**1104.83**		lbs/Mlb	**155.6953**	**0.0048**	**0.0008**	**156.0589**

2007 STEAM EMISSIONS COEFFICIENT

			Steam Coefficient per Mlb Delivered to Buildings	CO_2	CH_4	N_2O	CO_2e
Steam Generation Efficiency	120.3%						
Total Btu input/lb steam	**1144.24**		lbs/Mlb	**161.5285**	**0.0050**	**0.0009**	**161.9076**

2008 Steam Emissions Coefficient

To convert metered lbs of steam to Btu		Steam Fuel Breakdown & Emissions Coefficients						Steam Coefficient per MMBtu Delivered to Buildings divided by fuel mix percentage			
Lbs of steam generated per lb of steam delivered (1/0.85)	1.1655		CO2 (lbs/ MMBTU)	CH4 (lbs/ MMBtu)	N2O (lbs/ MMBtu)	CO2e (lbs/ MMBtu)	% of mix	CO2 (lbs/ MMBTU)	CH4 (lbs/ MMBtu)	N2O (lbs/ MMBtu)	CO2e (lbs/ MMBtu)
Steam Generation Efficiency	122.6%	Residual fuel Oil	165.57	0.0066	0.0013	166.1161	42.62%	70.5705	0.0028	0.0006	70.8045
Difference between delivery and generation	95.1%	Natural gas	116.89	0.0022	0.0002	117.0037	57.02%	66.6498	0.0013	0.0001	66.7152
steam btu/lb at generation	1193	Kerosene	165.79	0.0066	0.0013	166.3366	0.36%	0.5915	0.0000	0.0000	0.5935
water btu	18	Average	448.2439	0.0154	0.0029	449.4564	100.0%	**137.8118**	**0.0041**	**0.0007**	**138.1132**
net btu/lb	1175							Steam Coefficient per Mlb Delivered to Buildings			
Total btu input /lb steam	**1117.18**							CO2 (lb/Mlb)	CH4 (lb/Mlb)	N2O (lb/Mlb)	CO2e (lb/Mlb)
								153.9608	**0.0046**	**0.0008**	**154.2974**

2009 STEAM EMISSIONS COEFFICIENT

To convert metered lbs of steam to Btu		Steam Fuel Breakdown & Emissions Coefficients						Steam Coefficient per MMBTU Delivered to Buildings divided by fuel mix percentage			
Lbs of steam generated per lb of steam delivered (1/0.85)	1.1612		CO_2 (lbs/ MMBTU)	CH_4 (lbs/ MMBTU)	N_2O (lbs/ MMBTU)	CO_2e (lbs/ MMBTU)	% of mix	CO_2 (lbs/ MMBTU)	CH_4 (lbs/ MMBTU)	N_2O (lbs/ MMBTU)	CO_2e (lbs/ MMBTU)
Steam Generation Efficiency	114.6%	Residual fuel Oil	165.57	0.0066	0.0013	166.1161	44.82%	74.2141	0.0030	0.0006	74.4601
Difference between delivery and generation	101.3%	Natural gas	116.89	0.0022	0.0002	117.0037	54.60%	63.8175	0.0012	0.0001	63.8801
Steam Btu/lb at generation	1193	Kerosene	165.79	0.0066	0.0013	166.3366	0.58%	0.9602	0.0000	0.0000	0.9634
Water Btu	18	Average	448.2439	0.0154	0.0029	449.4564	100.0%	**138.9918**	**0.0042**	**0.0007**	**139.3037**
Net Btu/lb	1175							Steam Coefficient per Mlb Delivered to Buildings			
Total Btu input/lb steam	**1190.70**							CO_2 (lbs/Mlb)	CH_4 (lbs/Mlb)	N_2O (lbs/Mlb)	CO_2e (lbs/Mlb)
								165.4977	**0.0050**	**0.0009**	**165.8690**

Electricity Emissions Coefficients

2005 ELECTRICITY EMISSIONS COEFFICENT

	Generation	CO_2	CO_2/MWh	CH_4	CH_4/MWh	N_2O	N_2O/MWh	CO_2e	CO_2e/MWh	Source Energy	MMBTU/MWh
	GWh	tons	lbs	tons	lbs	tons	lbs	tons	lbs	MMBTU	MMBTU
In-city	25,452	16,470,228	1,303.2	386.9	0.03040	49.9	0.00392	16,608,265	1,305.1	221,280,670	8.6940
Contract	17,339	2,349,016	271.4	46.7	0.00539	4.7	0.00054	2,355,283	271.7	209,962,975	12.1094
NYISO Zone A	3,697	1,616,251	863.5	14.98	0.01021	23.4	0.01392	1,604,474	868.1	16,255,033	4.3972
NYISO Zone D	1,559	190,074	244.2	3.22	0.00485	0.3	0.00049	190,581	244.4	3,252,367	2.0858
Market procurement (Zone G, H, I)	5,960	3,333,228	1,141.9	98.6	0.03310	35.7	0.01199	3,415,879	1,146.2	74,388,049	12.4810
Zone G, H, I (minus Indian Point contracted)	11,209,977	6,400,469	1,118.5	185.5	0.03138	67.2	0.01180	6,424,690	1,122.7	74,388,049	6.6359
Total	54,007	23,958,798	887.2	550.5	0.01948	114.1	0.00419	24,004,697	888.9	525,139,094	**9.7235**
Total 2005 NYC consumption	51,397										
Transmission and generation loss rate	-4.83%								**lbs CO_2e/MWh**		
Coefficient with T&D losses			**930.1198**		**0.02042**		**0.00440**		**931.9017**		

2006 ELECTRICITY EMISSIONS COEFFICENT

	Generation	CO_2	CO_2/MWh	CH_4	CH_4/MWh	N_2O	N_2O/MWh	CO_2e	CO_2e/MWh	Source Energy	MMBTU/MWh
	GWh	tons	lbs	tons	lbs	tons	lbs	tons	lbs	MMBTU	MMBTU
Total	53,096	21,064,115	793.4	398	0.01497	95	0.00358	21,101,889	794.9	497,419,161	**9.3683**
Total 2005 NYC consumption	50,494										
Transmission and generation loss rate	-4.90%								**lbs CO_2e/MWh**		
Coefficient with T&D losses			**832.3118**		**0.0157**		**0.0038**		**833.8044**		

2007 ELECTRICITY EMISSIONS COEFFICENT

	Generation	CO_2	CO_2/MWh	CH_4	CH_4/MWh	N_2O	N_2O/MWh	CO_2e	CO_2e/MWh	Source Energy	MMBTU/MWh
	GWh	tons	lbs	tons	lbs	tons	lbs	tons	lbs	MMBTU	MMBTU
Total	54,750	21,165,273	773.2	401	0.01465	96	0.00349	19,549,422	774.6	519,014,351	**9.4797**
Total 2005 NYC consumption	52,278										
Transmission and generation loss rate	-4.51%								**lbs CO_2e/MWh**		
Coefficient with T&D losses			**808.0639**		**0.0153**		**0.0036**		**809.5164**		

2008 ELECTRICITY EMISSIONS COEFFICENT

	Generation	CO_2	CO_2/MWh	CH_4	CH_4/MWh	N_2O	N_2O/MWh	CO_2e	CO_2e/MWh	Source Energy	MMBTU/MWh
	GWh	tons	lbs	tons	lbs	tons	lbs	tons	lbs	MMBTU	MMBTU
In-city	24,214	13,017,244	1,075.2	257.2	0.02124	27.9	0.00231	13,031,302	1,076.3	219,945,550	9.0832
Contract	15,091	1,521,863	201.7	28.7	0.00380	2.9	0.00038	1,523,355	201.9	209,665,947	13.8932
NYISO Zone A	3,697	1,399,058	756.9	15.0	0.00811	23.4	0.01268	1,406,636	761.0	14,074,129	3.8072
NYISO Zone D	1,559	170,729	219.0	3.2	0.00413	0.3	0.00041	170,896	219.2	2,921,213	1.8734
Market procurement (Zone G, H, I)	8,711	3,349,889	769.2	49.1	0.01126	50.4	0.01157	3,366,537	773.0	89,964,845	10.3282
Market procurement (ROS)	1,563	397,295	508.5	7.1	0.00908	4.2	0.00542	398,727	510.3	10,019,616	6.4117
Zone G, H, I (minus Indian Point contracted)	8,710,589	3,349,889	769.2	49.1	0.01126	50.4	0.01157	3,366,537	769.2	89,964,845	10.3282
Total	54,835	19,856,078	724.2	360	0.01314	109	0.00398	19,498,727	725.7	536,571,683	**9.7852**
Total 2005 NYC consumption	51,758										
Transmission and generation loss rate	-5.61%								**lbs CO_2e/MWh**		
Coefficient with T&D losses			**764.8527**		**0.0139**		**0.0042**		**766.4465**		

2009 ELECTRICITY EMISSIONS COEFFICENT

	Generation	CO_2	CO_2/MWh	CH_4	CH_4/MWh	N_2O	N_2O/MWh	CO_2e	CO_2e/MWh	Source Energy	MMBTU/MWh
	GWh	tons	lbs	tons	lbs	tons	lbs	tons	lbs	MMBTU	MMBTU
In-city	23,106	11,811,436	1,022.4	224.1	0.01939	22.7	0.00196	11,823,164	1,023.4	201,786,918	8.7330
Contract	13,260	1,368,346	206.4	25.8	0.00389	2.6	0.00039	1,369,688	206.6	204,052,324	15.3887
NYISO Zone A	3,697	1,146,411	620.2	12.3	0.00663	19.2	0.01040	1,152,628	623.6	11,378,394	3.0780
NYISO Zone D	1,559	114,540	146.9	2.2	0.00277	0.2	0.00028	114,652	147.1	1,959,800	1.2569
Market procurement (Zone G, H, I)	9,524	2,663,085	559.2	41.2	0.00865	39.7	0.00833	2,676,249	562.0	92,010,951	9.6610
Market procurement (ROS)	1,954	425,455	435.5	7.6	0.00778	4.0	0.00414	426,828	436.9	12,087,588	6.1860
Zone G, H, I (minus Indian Point contracted)	9,523,911	2,663,085	559.2	41.2	0.00299	39.7	0.00288	2,676,249	562.0	92,010,951	9.6610
Total	53,100	17,529,274	660.2	313	0.01179	88	0.00333	17,136,380	661.5	523,275,975	**9.6269**
Total 2005 NYC consumption	50,633										
Transmission and generation loss rate	-4.65%								**lbs CO_2e/MWh**		
Coefficient with T&D losses			**690.9091**		**0.0123**		**0.0035**		**692.2466**		

Fuel Emissions Coefficients

2009 FUEL EMISSIONS COEFFICIENTS							
	UNIT	GREENHOUSE GAS (LBS/UNIT)				MMBTU/UNIT	FUEL EFFICIENCY (MILES/UNIT)
		CO_2	CH_4	N_2O	CO_2e		
Stationary source							
#2 Distillate Fuel Oil (building)**	gallon	22.50144	0.00335	0.00018	22.62830	0.13800	
#2 Distillate Fuel Oil (industrial)	gallon	22.50144	0.00091	0.00018	22.57719	0.13800	
#4 Distillate Fuel Oil (building)**	gallon	24.15349	0.00354	0.00019	24.28771	0.14600	
#4 Distillate Fuel Oil (industrial)**	gallon	24.15349	0.00097	0.00019	24.23364	0.14600	
#6 Residual Fuel Oil (building)	gallon	24.83507	0.00364	0.00020	24.97297	0.15000	
#6 Residual Fuel Oil (industrial)**	gallon	24.83507	0.00099	0.00020	24.91742	0.15000	
Biodiesel (100%)*	gallon	20.83703	0.00031	0.00003	20.85318	0.12800	
Kerosene (building)**	gallon	22.38133	0.00327	0.00018	22.50544	0.13500	
Kerosene (industrial)	gallon	22.38133	0.00089	0.00018	22.45544	0.13500	
Natural Gas (building)**	therm	11.68891	0.00110	0.00002	11.71889	0.10000	
Natural Gas (industrial)	therm	11.68891	0.00022	0.00002	11.70037	0.10000	
Propane (building)**	gallon	12.33015	0.00221	0.00012	12.41380	0.09100	
Propoane (industrial)	gallon	12.33015	0.00060	0.00012	12.38010	0.09100	
Mobile source							
On-road							
Biodiesel (100%), heavy trucks*	gallon	20.83368	0.00010	0.00009	20.86463	0.12810	12.69033
Compressed natural gas, bus	therm	11.69707	0.02418	0.00215	12.87204	0.10000	5.57860
Diesel, bus	gallon	22.50920	0.00014	0.00013	22.55382	0.13810	12.69033
Diesel, heavy-duty vehicles	gallon	22.50920	0.00010	0.00009	22.54014	0.13810	8.79932
Ethanol (100%), passenger cars*	gallon	12.67658	0.00188	0.00228	13.42417	0.08405	21.91949
Gasoline, light trucks	gallon	19.35659	0.00116	0.00160	19.87584	0.12500	16.71987
Gasoline, passenger cars	gallon	19.35659	0.00134	0.00142	19.82523	0.12500	21.91949
Off-road							
Aviation gasoline	gallon	18.32041	0.01552	0.00024	18.72152	0.12019	
Diesel, locomotives	gallon	22.50920	0.00176	0.00057	22.72393	0.13869	
Diesel, ships and boats	gallon	22.50920	0.00163	0.00057	22.72115	0.13869	
Jet fuel	gallon	21.09824	0.00060	0.00068	21.32260	0.13500	

*** Per the LGOP, CO_2 from biofuels is considered biogenic and is reported as a Scope 3 source**
**** Per the LGOP, building usage here is identified as residential, commerical, or institutional**

Heating and Cooling Degree Days

Heating and Cooling Degree Days, Central Park 2005-2009 Using 65 Degrees (°F) Base Temperature

	YEAR	ANNUAL TOTAL	% CHANGE FROM PREVIOUS YEAR
Calendar years			
Heating degree days	2005	4733	
Heating degree days	2006	3987	-15.76%
Heating degree days	2007	4705	18.01%
Heating degree days	2008	4598	-2.27%
Heating degree days	2009	4760	3.52%
Cooling degree days	2005	1472	
Cooling degree days	2006	1130	-23.23%
Cooling degree days	2007	1212	7.26%
Cooling degree days	2008	1163	-4.04%
Cooling degree days	2009	876	-24.68%
Fiscal years			
Heating degree days	2006	4261	
Heating degree days	2007	4460	4.67%
Heating degree days	2008	4470	0.22%
Heating degree days	2009	4835	8.17%
Cooling degree days	2006	1435	
Cooling degree days	2007	1177	-17.98%
Cooling degree days	2008	1202	2.12%
Cooling degree days	2009	1051	-12.56%

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

Citywide GHG Emissions Summary

	UNITS	2005			2006			2007		
		CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*
Buildings										
Distillate fuel oil	gallons	512,776,350	5,327,200	71,453,829	435,814,800	4,527,651	60,729,470	509,887,713	5,297,190	71,051,306
Electricity	kWh	48,341,915,006	20,434,297	470,054,427	47,460,914,019	17,950,066	444,627,995	49,222,433,013	18,074,009	466,614,596
Natural gas	therms	2,451,990,068	13,032,381	245,199,007	2,361,398,806	12,550,846	236,139,881	2,570,616,509	14,170,578	257,061,651
Residual fuel oil	gallons	234,325,007	2,654,094	35,148,751	199,155,648	2,255,747	29,873,347	233,004,978	2,639,143	34,950,747
Steam	mlbs	25,781,088	2,233,406	34,292,720	25,667,000	1,816,893	28,357,629	25,795,000	1,894,386	29,515,756
Transportation										
CNG - bus	therms	2,361,134	13,786	236,113	2,361,134	13,786	236,113	14,593,305	85,205	1,459,331
Biodiesel B5 - bus	gallons									
Diesel - bus	gallons	66,395,066	679,264	9,168,842	66,395,066	679,238	9,168,842	66,395,066	679,238	9,168,842
Diesel - commuter rail	gallons	1,375,601	14,179	190,783	1,400,047	14,431	194,173	1,400,047	14,431	194,173
Diesel - heavy trucks	gallons	87,453,399	893,985	12,076,898	77,522,803	792,596	10,705,530	82,183,167	840,244	11,349,104
Diesel - solid waste transport - rail	gallons	2,518,771	25,962	349,330	2,944,671	30,352	408,398	3,135,129	32,315	434,813
Diesel - solid waste transport - truck	gallons	10,231,141	104,587	1,412,872	9,499,511	97,123	1,311,837	8,363,139	85,505	1,154,910
Electricity - subways and commuter rail	kWh	2,728,682,604	1,153,424	26,268,754	2,635,967,148	996,942	24,694,526	2,734,550,607	1,004,101	25,922,758
Gasoline - light trucks	gallons	94,317,784	769,894	11,789,723	93,634,614	763,572	11,704,327	93,792,861	766,580	11,724,108
Gasoline - passenger cars	gallons	820,349,005	6,696,317	102,543,626	817,209,572	6,664,184	102,151,196	811,095,080	6,629,178	101,386,885
Streetlights and traffic signals										
Electricity	kWh	318,925,241	134,811	3,101,082	313,776,281	118,672	2,939,550	313,555,546	115,135	2,972,417
Fugitive and process emissions										
CH_4 - landfills	MT	5,651	118,667		5,523	115,988		5,053	106,114	
CH_4 - natural gas distribution	therms	37,520,844	70,056		36,134,599	67,468		39,014,319	72,844	
CH_4 - wastewater treatment plants	MT	6,545	137,444		6,545	259,295		12,347	259,295	
HFCs - municipal fleet	MT	10	12,622		9	11,200		9	11,378	
N_2O - wastewater treatment process	MT	285	88,361		275	85,294		279	86,624	
SF_6 - electricity distribution	pounds	187,952	2,037,561		137,149	1,486,813		96,551	1,046,696	
Total Scope 1			**32,676,360**	**489,569,773**		**30,415,583**	**462,623,115**		**32,822,558**	**499,935,869**
Total Scope 2			**23,955,937**	**533,716,984**		**20,882,573**	**500,619,700**		**21,087,630**	**525,025,527**
TOTAL Scope 1 and 2			**56,632,297**	**1,023,286,757**		**51,298,156**	**963,242,815**		**53,910,188**	**1,024,961,396**
Scope 3										
Biogenic CO_2 from fuel	MT		524,391			509,295			495,965	
Exported solid waste landfill gas	MT		2,699,120			2,702,362			2,691,282	
Aviation emissions	MT		14,345,894			14,146,259			15,733,804	
TOTAL Scope 3			**17,569,405**			**17,357,916**			**18,921,051**	

*** All MMBTU figures represent source MMBTU**

	UNITS	2008			2009			% CHANGE 2008 - 2009			% CHANGE 2005 - 2009		
		CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*
Buildings													
Distillate fuel oil	gallons	498,848,992	5,182,509	69,513,094	515,562,545	5,356,146	71,842,081	3.35%	3.35%	3.35%	0.54%	0.54%	0.54%
Electricity	kWh	48,567,357,167	16,884,650	475,241,516	47,446,592,025	14,898,124	456,763,594	-2.31%	-11.77%	-3.89%	-1.85%	-27.09%	-2.83%
Natural gas	therms	2,578,412,147	13,704,880	257,841,215	2,568,278,563	13,651,161	256,827,856	-0.39%	-0.39%	-0.39%	4.74%	4.75%	4.74%
Residual fuel oil	gallons	227,960,579	2,582,007	34,194,087	235,597,893	2,668,512	35,339,684	3.35%	3.35%	3.35%	0.54%	0.54%	0.54%
Steam	mlbs	23,833,964	1,668,095	26,626,859	22,758,555	1,712,283	27,098,628	-4.51%	2.65%	1.77%	-11.72%	-23.33%	-20.98%
Transportation													
CNG - bus	therms	15,128,859	88,332	1,512,886	14,565,515	85,043	1,456,552	-3.72%	-3.72%	-3.72%	516.89%	516.89%	516.89%
Biodiesel B5 - bus	gallons	3,722,965	36,184	514,124	14,497,125	140,898	2,001,984	289.40%	289.40%	289.40%			
Diesel - bus	gallons	51,074,334	522,505	7,053,122	35,220,954	360,319	4,863,846	-31.04%	-31.04%	-31.04%	-46.95%	-46.95%	46.95%
Diesel - commuter rail	gallons	1,408,756	14,521	195,381	1,364,645	14,066	189,263	-3.13%	-3.13%	-3.13%	-0.80%	-0.80%	-0.80%
Diesel - heavy trucks	gallons	79,644,242	814,259	10,998,491	78,167,643	799,189	10,794,579	-1.85%	-1.85%	-1.85%	-10.62%	-10.60%	-10.62%
Diesel - solid waste transport - rail	gallons	3,357,812	34,610	465,697	3,500,510	36,081	485,487	4.25%	4.25%	4.25%	38.98%	38.98%	38.98%
Diesel - solid waste transport - truck	gallons	5,500,496	56,235	759,592	5,412,994	55,343	747,509	-1.59%	-1.59%	-1.59%	-47.09%	-47.08%	-47.09%
Electricity - subways and commuter rail	kWh	2,877,865,744	1,000,502	28,160,505	2,914,932,407	915,282	28,061,763	1.29%	-8.52%	-0.35%	6.83%	-20.65%	6.83%
Gasoline - light trucks	gallons	93,301,328	763,428	11,662,666	93,958,574	765,070	11,744,822	0.70%	0.22%	0.70%	-0.38%	-0.63%	-0.38%
Gasoline - passenger cars	gallons	833,181,235	6,817,413	104,147,654	837,671,018	6,820,843	104,708,877	0.54%	0.05%	0.54%	2.11%	1.86%	2.11%
Streetlights and traffic signals													
Electricity	kWh	312,580,297	108,670	3,058,662	271,592,667	85,279	2,614,595	-13.11%	-21.52%	-14.52%	-14.84%	-36.74%	
Fugitive and process emissions													
CH_4 - landfills	MT	5,026	105,548		4,869	102,241		-3.13%	-3.13%		-13.84%	-13.84%	
CH_4 - natural gas distribution	therms	39,579,572	73,420		39,853,812	73,929		0.69%	0.69%		6.22%	5.53%	
CH_4 - wastewater treatment plants	MT	12,002	252,035		10,808	227,121		-9.94%	-9.88%		65.14%	65.25%	
HFCs - municipal fleet	MT	9	11,580		9	11,354		0.40%	-1.95%		-7.06%	-10.04%	
N_2O - wastewater treatment process	MT	277	85,983		282	87,276		1.50%	1.50%		-1.20%	-1.20%	
SF_6 - electricity distribution	pounds	59,457	644,565		40,254	436,387		-32.30%	-32.30%		-78.58%	-78.58%	
Total Scope 1			**31,790,013**	**498,858,008**		**31,690,978**	**501,002,541**		**-0.31%**	**0.43%**		**-3.02%**	**2.34%**
Total Scope 2			**19,661,917**	**533,087,542**		**17,610,970**	**514,538,580**		**-10.43%**	**-3.48%**		**-26.49%**	**-3.59%**
TOTAL Scope 1 and 2			**51,451,929**	**1,031,945,550**		**49,301,948**	**1,015,541,121**		**-4.18%**	**-1.59%**		**-12.94%**	**-0.76%**
Scope 3													
Biogenic CO_2 from fuel	MT		500,922			515,616			2.93%			-1.67%	
Exported solid waste landfill gas	MT		2,687,027			2,654,098			-1.23%			-1.67%	
Aviation emissions	MT		14,343,938			14,179,668			-1.15%			-1.16%	
TOTAL Scope 3			**17,531,886**			**17,349,382**			**-1.04%**			**-1.25%**	

*** All MMBTU figures represent source MMBTU**

Municipal GHG Emissions Summary

	UNITS	FY 2006			FY 2007			FY 2008			FY 2009		
		CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*
Buildings													
Distillate fuel oil	gallons	22,508,188	236,948	3,169,089	23,981,074	252,454	3,376,467	22,069,094	232,036	3,104,180	22,603,586	238,388	3,189,473
Electricity	kWh	3,087,522,959	1,167,724	30,021,646	3,254,020,244	1,194,845	30,847,182	3,300,869,846	1,147,562	32,299,686	3,305,071,569	1,037,785	31,817,593
Natural Gas	therms	103,772,646	551,614	10,377,265	108,142,419	574,842	10,814,242	107,575,157	571,827	10,757,516	110,907,681	589,541	11,090,768
Propane	gallons	0	0	0	27,956	157	2,544	0	0	0	0	0	0
Residual fuel oil	gallons	20,328,026	230,267	3,049,204	18,768,141	212,597	2,815,221	20,453,024	231,683	3,067,954	20,690,429	234,372	3,103,564
Steam	Mlbs	1,813,855	128,398	2,003,998	1,881,702	138,192	2,153,124	1,900,890	133,040	2,123,639	1,905,860	143,391	2,129,192
Streetlights and traffic signals													
Electricity	kWh	306,246,001	115,824	2,977,794	305,782,427	112,180	2,898,730	304,843,185	105,980	2,982,953	264,800,723	83,147	2,549,210
Wastewater treatment													
Distillate fuel oil	gallons	4,447,923	45,668	615,061	4,920,953	50,524	680,472	4,866,711	49,967	672,971	4,774,272	49,042	660,441
Electricity	kWh	587,886,001	222,343	5,716,332	601,576,209	220,893	5,702,771	601,624,495	209,157	5,887,019	632,689,781	198,663	6,090,841
Methane	MT		148,426			194,772			245,974			251,785	
Natural Gas	therms	3,677,037	19,515	367,704	5,657,225	30,024	565,723	7,339,970	38,955	733,997	7,784,567	41,314	778,457
Nitrous oxide	MT	268	83,134		277	85,808		283	87,790		288	89,138	
Propane	gallons				481	3	44	817	5	74	0	0	0
Steam	Mlbs	2,822	200	3,118	3,262	240	3,733	5,024	352	5,613	5,024	378	5,613
Water supply													
Distillate fuel oil	gallons	139,367	1,427	20,348	154,189	1,579	22,512	233,216	2,388	34,049	195,704	1,960	27,007
Electricity	kWh	62,132,608	23,499	604,149	65,428,474	24,025	620,243	68,332,051	23,756	668,643	65,911,585	20,696	634,524
Kerosene	gallons	0	0	0	15,841	161	2,139	21,176	216	2,859	17,136	175	2,313
Natural Gas	therms	502,343	2,666	50,234	509,724	2,705	50,972	647,374	3,436	64,737	688,428	3,654	68,843
Propane	gallons	1,079,769	6,063	98,259	1,171,819	6,580	106,636	1,302,280	7,313	118,507	1,364,044	7,660	124,128
Steam	Mlbs	3,720	263	4,110	3,850	283	4,405	4,426	310	4,945	4,417	332	4,935
Transportation													
Diesel and biodiesel - trucks	gallons	15,216,757	156,185	2,101,362	15,452,221	158,602	2,133,878	15,577,983	159,270	2,151,245	16,021,840	157,459	2,212,472
Diesel - marine vessels	gallons	4,265,000	43,956	588,570	4,348,900	44,820	600,148	4,481,941	46,192	618,508	4,679,855	48,231	645,820
Diesel - solid waste transport, rail	gallons	2,731,721	28,157	378,864	3,157,621	32,547	437,932	3,112,638	32,083	431,693	3,341,728	34,445	463,466
Diesel - solid waste transport, truck	gallons	9,865,326	100,863	1,362,355	9,133,696	93,376	1,261,320	7,592,582	77,624	1,048,499	5,469,819	55,924	755,356
Ethanol (E85)	gallons	123,000	281	11,093	82,515	189	7,442	76,340	175	6,885	83,642	160	7,863
Gasoline	gallons	15,170,768	123,534	1,835,931	15,548,762	129,792	1,882,899	15,801,166	129,105	1,914,513	15,471,631	125,936	1,871,722
Jet fuel	gallons	227,126	2,197	30,662	261,864	2,533	35,352	233,303	2,256	31,496	217,587	2,104	29,374
Solid waste facilities													
Methane	MT		119,499			110,542			105,576			102,548	
Other fugitive and process emissions													
HFCs - municipal fleet	MT		11,370			11,563			11,685			11,354	
Total Scope 1			**1,911,770**	**24,055,999**		**1,996,171**	**24,795,941**		**2,035,554**	**24,759,685**		**2,045,189**	**25,031,068**
Total Scope 2			**1,658,251**	**41,331,146**		**1,690,758**	**42,230,188**		**1,620,156**	**43,972,497**		**1,484,393**	**43,231,908**
TOTAL Scope 1 and 2			**3,570,021**	**65,387,146**		**3,686,929**	**67,026,129**		**3,655,710**	**68,732,182**		**3,529,581**	**68,262,975**
Scope 3													
Employee commute	MT		224,207			223,248			237,830			228,868	
Biogenic CO_2e from fuel	MT		13,625			13,746			20,940			15,239	
Employee solid waste	MT		174,178			176,400			179,015			177,192	
TOTAL Scope 3			**412,010**			**413,394**			**437,785**			**429,070**	

*** All MMBTU figures represent source MMBTU**

	UNITS	CY 2008			CY 2009			% CHANGE FY 2008 - 2009			% CHANGE FY 2006 - 2009			% CHANGE CY 2008 - 2009		
		CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*	CONSUMED	$MTCO_2e$	MMBTU*
Buildings																
Distillate fuel oil	gallons	22,312,339	234,593	3,138,395	21,105,574	223,014	2,980,984	2.42%	2.74%	2.75%	0.42%	0.61%	0.64%	-5.41%	-4.94%	-5.02%
Electricity	kWh	3,303,755,994	1,148,565	32,327,928	3,285,182,375	1,031,540	31,626,122	0.13%	-9.57%	-1.49%	7.05%	-11.13%	5.98%	-0.56%	-10.19%	-2.17%
Natural Gas	therms	102,609,982	545,434	10,260,998	108,353,726	575,965	10,835,373	3.10%	3.10%	3.10%	6.88%	6.88%	6.88%	5.60%	5.60%	5.60%
Propane	gallons	0	0	0	0	0	0									
Residual fuel oil	gallons	20,614,802	233,515	3,092,220	20,999,247	237,870	3,149,887	1.16%	1.16%	1.16%	1.78%	1.78%	1.78%	1.86%	1.86%	1.86%
Steam	Mlbs	1,864,991	130,527	2,083,534	1,865,498	140,354	2,084,100	0.26%	7.78%	0.26%	5.07%	11.68%	6.25%	0.03%	7.53%	0.03%
Streetlights and traffic signals																
Electricity	kWh	305,529,815	106,219	2,989,672	264,806,834	83,149	2,549,269	-13.14%	-21.54%	-14.54%	-13.53%	-28.21%	-14.39%	-13.33%	-21.72%	-14.73%
Wastewater treatment																
Distillate fuel oil	gallons	4,492,773	46,128	621,263	5,011,692	51,531	693,823	-1.90%	-1.85%	-1.86%	7.34%	7.39%	7.38%	11.55%	11.71%	11.68%
Electricity	kWh	607,198,511	211,095	5,941,562	655,766,070	205,909	6,312,994	5.16%	-5.02%	3.46%	7.62%	-10.65%	6.55%	8.00%	-2.46%	6.25%
Methane	MT		252,035			227,121			2.36%			69.64%			-9.88%	
Natural Gas	therms	7,150,481	37,949	715,048	6,598,620	35,020	659,862	6.06%	6.06%	6.06%	111.71%	111.71%	111.71%	-7.72%	-7.72%	-7.72%
Nitrous oxide	MT	277	85,983		282	87,276		1.54%	1.54%		7.22%	7.22%		1.50%	1.50%	
Propane	gallons	471	3	43	0	0	0	-100.00%	-100.00%	-100.00%				-100.00%	-100.00%	-100.00%
Steam	Mlbs	4,945	346	5,524	2,977	224	3,326	0.00%	7.50%	0.00%	78.03%	89.22%	80.02%	-39.80%	-35.28%	-39.80%
Water supply																
Distillate fuel oil	gallons	199,776	2,201	29,167	218,418	2,202	30,142	-16.08%	-17.92%	-20.68%	40.42%	37.36%	32.73%	9.33%	0.03%	3.34%
Electricity	kWh	66,804,052	23,225	653,691	65,985,537	20,719	635,236	-3.54%	-12.88%	-5.10%	6.08%	-11.93%	5.03%	-1.23%	-10.79%	-2.82%
Kerosene	gallons	24,386	248	3,292	12,813	131	1,730	-19.08%	-19.08%	-19.08%				-47.46%	-47.46%	-47.46%
Natural Gas	therms	713,863	3,789	71,386	717,401	3,807	71,740	6.34%	6.34%	6.34%	37.04%	37.04%	37.04%	0.50%	0.50%	0.50%
Propane	gallons	1,178,524	6,618	107,246	1,302,483	7,314	118,526	4.74%	4.74%	4.74%	26.33%	26.33%	26.33%	10.52%	10.52%	10.52%
Steam	Mlbs	4,241	297	4,738	5,026	378	5,615	-0.20%	7.28%	-0.20%	18.74%	26.20%	20.06%	18.51%	27.40%	18.51%
Transportation																
Diesel and biodiesel - trucks	gallons	16,802,382	171,788	2,330,330	16,752,563	164,933	2,313,869	2.85%	-1.14%	2.85%	5.29%	0.82%	5.29%	-0.30%	-3.99%	-0.71%
Diesel - marine vessels	gallons	4,333,623	44,663	601,032	4,354,231	44,875	603,890	4.42%	4.42%	4.42%	9.73%	9.73%	9.73%	0.48%	0.48%	0.48%
Diesel - solid waste transport, rail	gallons	3,135,129	32,315	434,813	3,500,510	36,081	485,487	7.36%	7.36%	7.36%	22.33%	22.33%	22.33%	11.65%	11.65%	11.65%
Diesel - solid waste trasnport, truck	gallons	8,363,139	85,502	1,154,910	5,412,994	55,343	747,509	-27.96%	-27.96%	-27.96%	-44.56%	-44.56%	-44.56%	-35.28%	-35.27%	-35.28%
Ethanol (E85)	gallons	94,389	216	11,373	61,701	142	6,083	9.57%	-8.39%	14.21%	-32.00%	-43.14%	-29.12%	-34.63%	-34.10%	-46.51%
Gasoline	gallons	15,297,459	125,170	2,032,653	14,959,893	121,939	1,809,813	-2.09%	-2.45%	-2.24%	1.98%	-2.97%	1.95%	-2.21%	-2.58%	-10.96%
Jet fuel	gallons	228,414	2,209	30,836	214,693	2,076	28,984	-6.74%	-6.74%	-6.74%	-4.20%	-4.20%	-4.20%	-6.01%	-6.01%	-6.01%
Solid waste facilities																
Methane	MT		105,548			102,241			-2.87%			-14.19%			-3.13%	
Other fugitive and process emissions																
HFCs - municipal fleet	MT		11,580			11,354			-2.83%			-0.13%			-1.95%	
Total Scope 1			**2,027,486**	**24,635,005**		**1,990,238**	**24,537,702**		**0.47%**	**1.10%**		**6.98%**	**4.05%**		**-1.84%**	**-0.39%**
Total Scope 2			**1,620,274**	**44,006,648**		**1,482,274**	**43,216,662**		**-8.38%**	**-1.68%**		**-10.48%**	**4.60%**		**-8.52%**	**-1.8%**
TOTAL Scope 1 and 2			**3,647,759**	**68,641,653**		**3,472,512**	**67,754,364**		**-3.45%**	**-0.68%**		**-1.13%**	**4.40%**		**-4.80%**	**-1.29%**
Scope 3																
Employee commute	MT		234,365			230,774			-3.77%			2.08%			-1.53%	
Biogenic CO_2e from fuel	MT		22,445			20,238			-27.23%			11.84%			-9.83%	
Employee solid waste	MT		176,856			178,741			-1.02%			1.73%			1.07%	
TOTAL Scope 3			**433,666**			**429,753**			**-3.77%**			**2.25%**			**-0.90%**	

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Figures and Tables

All calculations presented in this report are based on data submitted to the New York City Mayor's Office. While every effort has been made to ensure these data's accuracy, the possibility for errors exists. This report is not intended to be a flawless accounting of New York City's carbon emissions, but is rather intended to provide guidance from which policy decisions may be based. The City of New York does not accept responsibility for the completeness or accuracy of this report, and it shall not be held liable for any damage or loss that may result, either directly or indirectly, as a result of its use.

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