INVENTORY OF NEW YORK CITY GREENHOUSE GAS EMISSIONS IN 2014

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The City of New York
Mayor Bill de Blasio
Mayor's Office of Sustainability

COMPACT of MAYORS COMPLIANT 2015

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INVENTORY OF NEW YORK CITY GREENHOUSE GAS EMISSIONS

APRIL 2016

Letter from the Mayor

Friends,

Since 2007, New York City has annually measured its citywide and government operations greenhouse gas emissions. Cities are where most of the world's population lives, and coastal cities like ours are among those most impacted by climate change. Our annual measurement allows us to see how we are doing in our efforts to reduce city government, and citywide, emissions. Over the years, this inventory has provided us with valuable data to help us develop the right strategy to combat climate change and ultimately meet our goal of reducing greenhouse gas emissions 80% by 2050.

We were one of the first cities to track emissions, and one of the few to date that measures them annually. This year, we joined over 400 cities in the Compact of Mayors. Launched at the 2014 United Nations Climate Summit, the Compact of Mayors is the world's largest coalition of city leaders addressing climate change by pledging to reduce their greenhouse gas emissions, tracking their progress, and preparing for the impacts of climate change.

One of the benefits of participating in the Compact is its new, state of the art standards for measuring greenhouse gas emissions, which many cities around the globe recently agreed to use in order to effectively compare their emissions.

This new, innovative greenhouse gas inventory shows that emissions in 2014 dropped 12 percent since 2005, despite economic growth, an extremely cold winter, and increased population. As we outlined in One City: Built to Last, reductions to date had been almost entirely the result of switching to natural gas in the electricity grid. We've also learned through our data collection that stationary energy use from the city's building stock is the biggest source of emissions. At the same time, our efforts to date have meant that even though New York City's population and jobs have jumped over the last few years, and even with a few tough winters our greenhouse gas emissions per person have been stable.

But there is much more work ahead in pursuit of our ambitious, necessary, and achievable goals – and a strong pathway that we've outlined to get there. In the Buildings Technical Working Group companion report we are releasing this week, we outline measures that will help achieve the substantial reductions we need from our largest source of emissions, and put us on a path toward reaching our 80 x 50 goal.

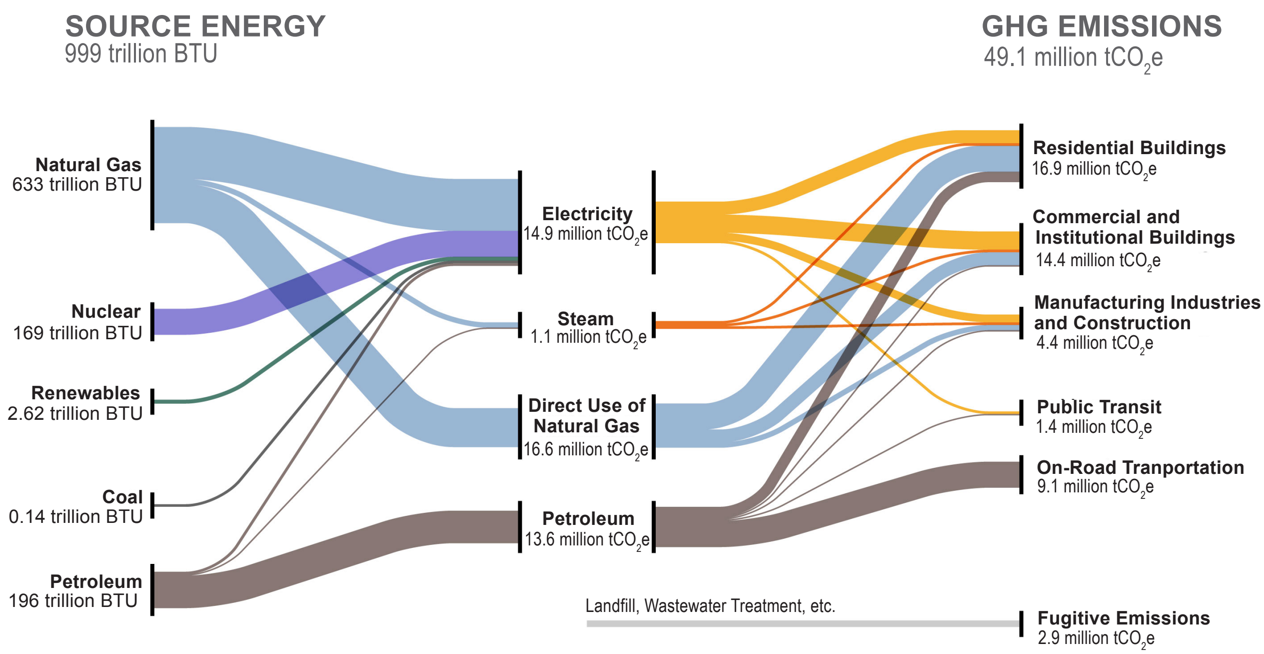
Mayor Bill de Blasio

Overview

New York City Energy Use and Greenhouse Gas Emissions

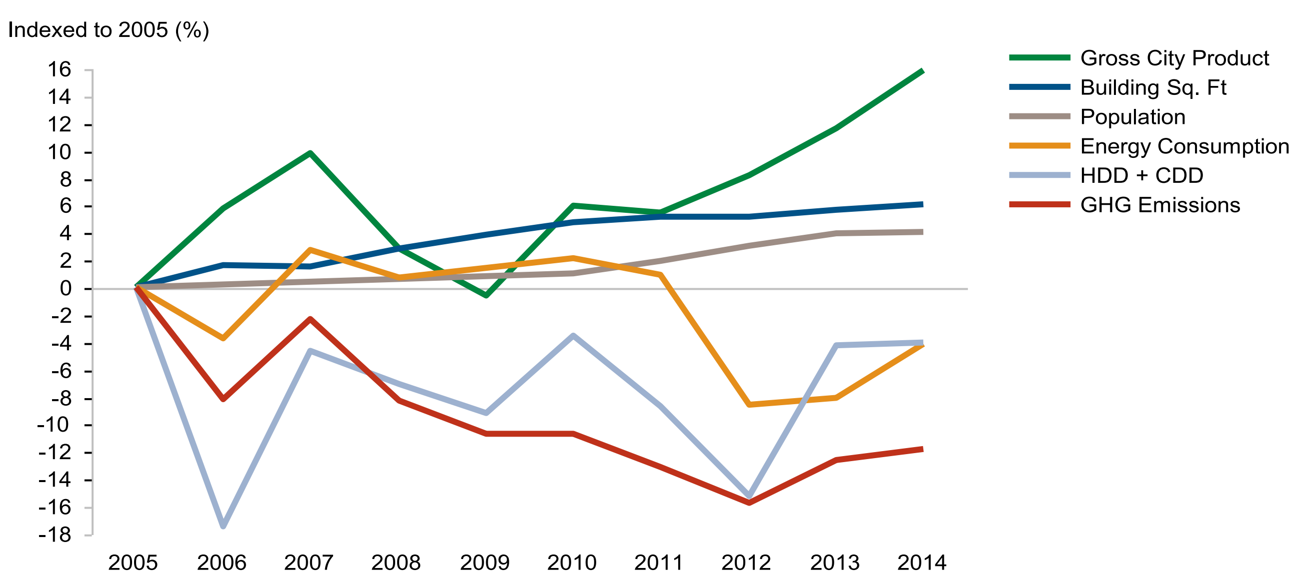
In 2014, New York City buildings were responsible for 73 percent of citywide greenhouse gas (GHG) emissions through the use of natural gas, electricity, heating oil, steam, and biofuel. The transportation sector accounted for 21 percent and the remaining GHG emissions stem largely from fugitive emissions released from landfills and wastewater treatment plants.

Fig. 1: 2014 New York City Energy Consumption and Greenhouse Gas Emissions



Source: NYC Mayor's Office

Fig. 2: Energy, GHG Emissions, and Economic Indicators



Source: NYC Mayor's Office

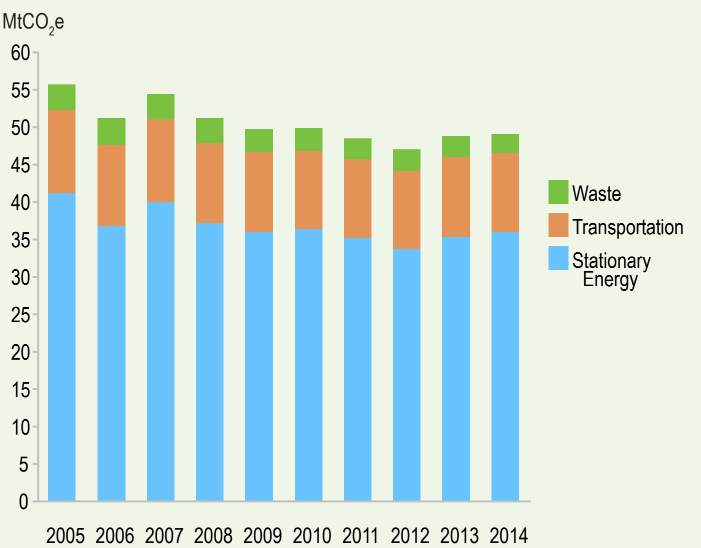
Introduction

Since 2005, GHG emissions have decreased in New York City citywide by approximately 12 percent despite significant increases in New York City's population, building area, and economic activity (see Figure 2). New York City's per capita GHG emissions in 2014 was an average of 5.8 tCO_2e (metric tons of carbon dioxide equivalent) emissions per capita, significantly lower than the American average of 17 tCO_2e per capita. In the first seven years of tracking the City's emissions, cleaner and more efficient electricity generation was the most significant driver behind GHG emission reductions.

The City of New York is compliant with the Compact of Mayors, a global cooperative effort among mayors and city officials to reduce GHG emissions, track progress and prepare for the impacts of climate change. The City has committed to working with cities across the globe and to use consistent best practices in GHG emissions accounting in a shared effort to track progress toward climate mitigation goals. As a result, this GHG emissions inventory follows the guidance of the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). New York's GHG mitigation goals are based on the GPC BASIC level – GHG emissions from stationary energy use, in-boundary transportation, and waste management.

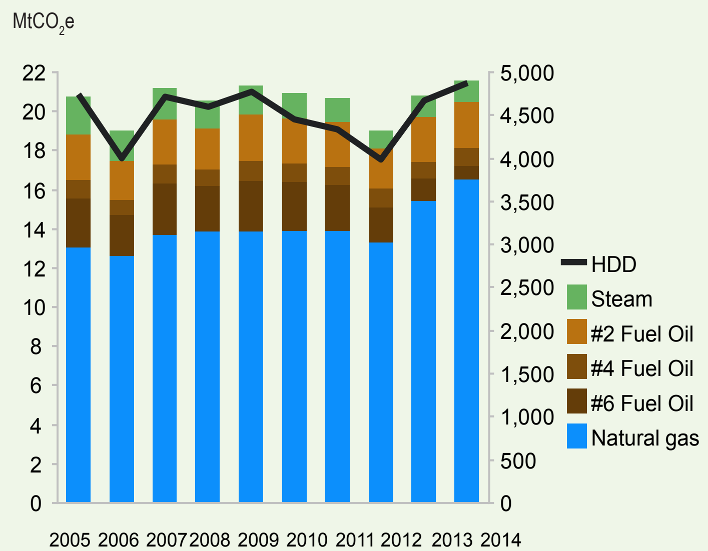
The chart below shows citywide GHG emissions from 2005 to 2014, by GPC sector. GHG emissions both citywide and in City government have decreased significantly in comparison to the base years (2005 and Fiscal Year 2006, respectively). In the first five years of tracking the city's emissions, the most significant driver behind GHG emissions reductions was the switching of the fuel source from carbon-intensive coal to natural gas – a less carbon-intensive energy source and the construction of new, highly efficient natural gas power plants.

Fig. 3: Citywide Annual GHG Emissions by Sector, 2005-2014



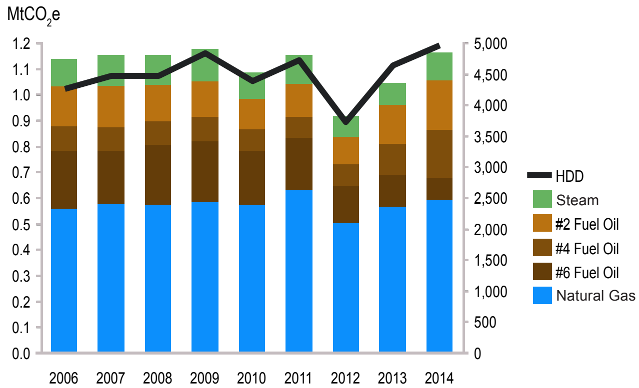
Source: NYC Mayor's

Fig. 4: Citywide Stationary Energy Heating Fuel GHG Emissions and Heating Degree Days, 2005-2014



Source: NYC Mayor's

Fig. 5: City Government Buildings Heating Fuel GHG Emissions and Heating Degree Days



Source: NYC Mayor's Office

Since 2012 the rate of reduction has slowed and GHG emissions as reported in 2013 and 2014 are now more closely tracking the fall and rise of temperatures. GHG emissions track very closely to the cold days of winter as a result of rising thermal demands and heating needs. This is especially evident in the 2014 GHG emissions inventory, as 2014 was the coldest year since 2005. GHG emissions that result from increased use of energy to meet heating needs were offset in part by energy efficiency gains as a result of City programs and policies.

Due to the recent declining rates of GHG emissions reductions, and the clear effects of adverse weather on the City's GHG emissions (particularly as observed with regard to heating requirements in 2013 and 2014), the City has developed accelerated policy drivers and renewed GHG mitigation strategies to further its commitment to reducing emissions by 80 percent below 2005 levels by 2050 ("80 x 50"). As a first step in achieving this goal, the City will accelerate building retrofits, as described in the plan "One City Built to Last," a ten-year action plan to improve the energy efficiency of the city's buildings by 2025. City government is committed to leading the way to this goal, targeting a 35 percent reduction in City government buildings' GHG emissions by 2025.

In addition, a Buildings Technical Working Group process identified and prioritized specific technology and policy options to achieve deep carbon reductions within the buildings sector by 2050. In order to reach the City's 80 x 50 goal, GHG reductions are required across all sectors as described within One New York, the City's long-term sustainability plan. The City is developing an integrated 80 x 50 Action Plan which includes the buildings, energy supply, transportation, and solid waste sectors.

As New York City pursues its GHG emissions reduction target, the GHG Inventory will continue to play a key role in measuring success, and will provide the necessary metrics for revising and optimizing strategies in pursuit of the 80 x 50 goal. By committing to the GPC, the City continues to demonstrate its leadership through the development of a transparent GHG inventory, comparable to those completed by hundreds of cities around the world now following the guidance of the GPC. In addition, the GPC allows city inventories to be aggregated at subnational and national levels, enabling the City to measure its contribution to northeast states' regional and U.S. national GHG emissions reduction targets, and helping it to identify innovative transboundary strategies for additional GHG mitigation, beyond the city's geographic boundary.

Executive Summary

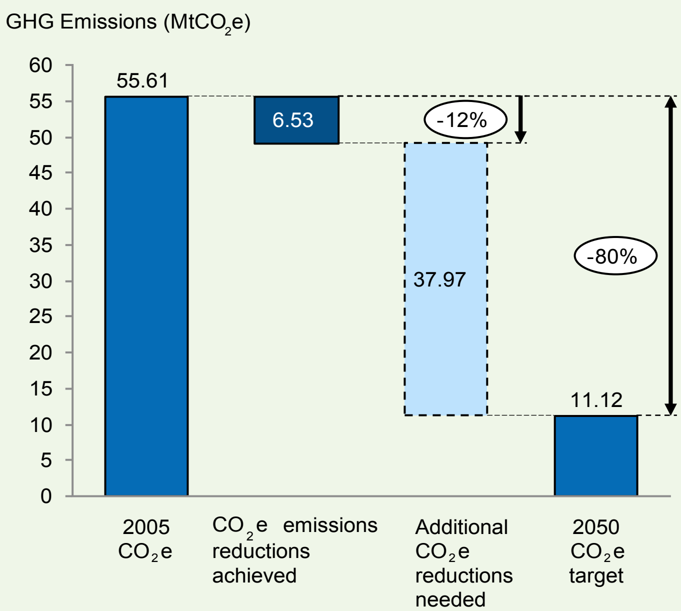
Climate change is an existential threat to our city, our country, and our planet. The United Nations Framework Convention on Climate Change has called for limiting temperature increases this century to 2 degrees Celsius, requiring a 50 percent reduction in global greenhouse gas (GHG) emissions and an 80 percent GHG reduction in developed countries by 2050. New York City has committed to reducing the city's greenhouse gas emissions by 80 percent over 2005 levels by 2050 ("80 x 50"). City government operations will lead the way with a target reduction of 35 percent over fiscal year ("FY") 2006 levels by 2025. In December 2015, 196 countries negotiated the Paris Agreement at the United Nations Climate Change Conference, COP 21, agreeing to reduce GHG emissions to levels necessary to limit global temperature increase to less than 2 degrees Celsius. New York City is committed to doing its part to achieve this goal.

The City of New York has become a global leader in the development and implementation of carbon accounting methodologies. The *Inventory of New York City Greenhouse Gas Emissions* is the tool by which the City tracks its progress toward meeting its climate mitigation goals. Local Law 22 of 2008 requires the City to update both the citywide and City government GHG inventories annually.

Methodology

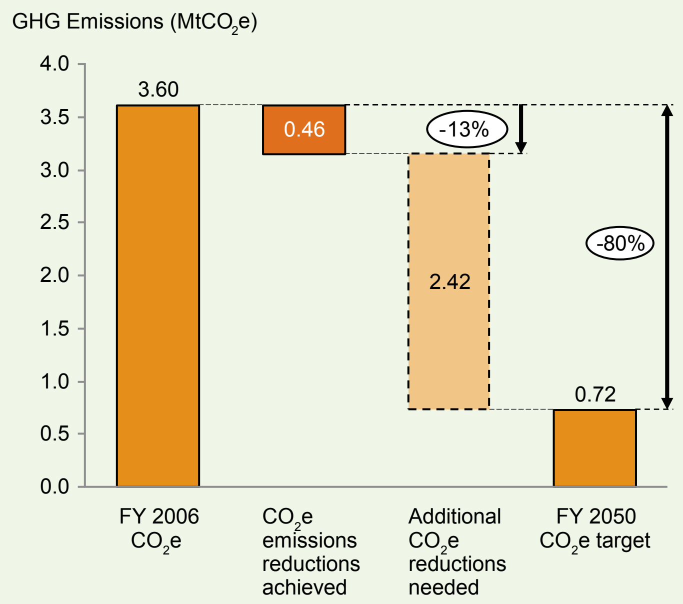
The Inventory of New York City Greenhouse Gas Emissions measures and reports GHG emissions from two sets of sources: all activities taking place within the boundary of New York City are reported in the citywide inventory (referred to as the community inventory in

Fig. 6: Citywide CO_2e Emissions Reduction Summary



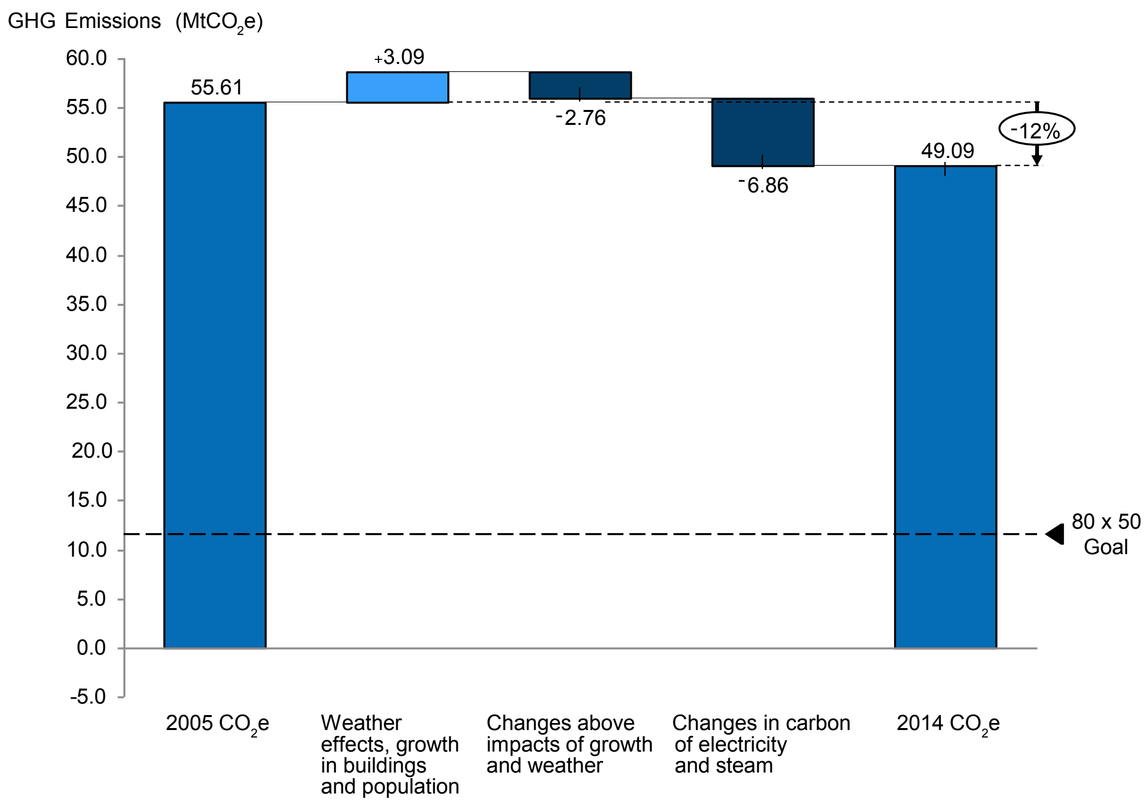
Source: NYC Mayor's Office

Fig. 7: City Government CO_2e Emissions Reduction Summary



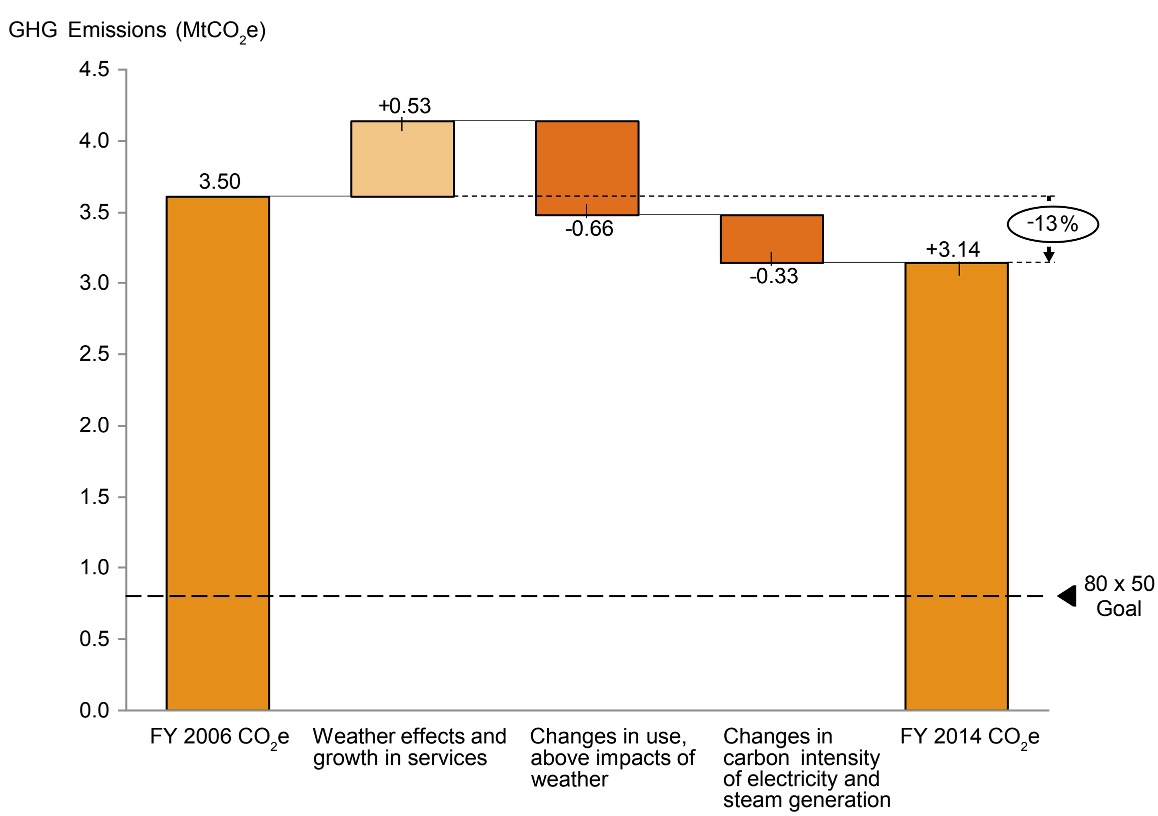
Source: NYC Mayor's Office

Fig. 8: Citywide 2005-2014 CO_2e Emissions Drivers



Source: NYC Mayor's Office

Fig. 9: City Government 2006-2014 CO_2e Emissions Drivers



Source: NYC Mayor's Office

GHG protocols); and the activities associated with the provision of services by New York City Government (a subset of the citywide inventory), reported in the City government GHG Inventory.

This year, additional data sets were accounted for in the GHG Inventory for the first time to ensure compliance with the Compact of Mayors, a global cooperative effort among mayors and city officials to reduce GHG emissions, track progress, and prepare for the impacts of climate change. The City has committed to working with cities across the globe and to use consistent best practices in GHG emissions accounting in a shared effort to track progress toward climate mitigation goals, including following the guidance of the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).

The citywide GPC BASIC GHG inventory consists of all direct and indirect GHG emissions from energy used by buildings and other stationary sources; on-road transportation and public transit within the geographic borders of New York City; and fugitive GHG emissions from wastewater treatment, in city landfills, solid waste disposed out of the city, and natural gas distribution within New York City.

City government emissions are calculated and reported per the Local Government Operations Protocol (LGOP).[2] The inventory reports GHG emissions from operations, facilities, or sources wholly owned by the City, or over which the City has full authority to introduce and implement operations, health and safety, and environmental policies (including both GHG- and non-GHG-related policies). GHG emissions from leased real estate and vehicles and other equipment are included. It is important to note that additional, non-City operated public entities (e.g., Metropolitan Transportation Authority) are not included within the GPC BASIC GHG inventory protocol by this definition of operational control.

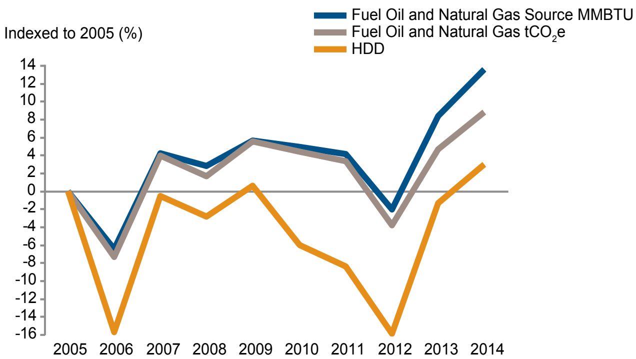
Results

As of 2014, citywide GHG emissions have decreased relative to 2005 levels by 11.7 percent, resulting in citywide GHG emissions of 49.1 million tCO_2e ($MtCO_2e$) in 2014. This corresponds to a 1.0 percent increase over 2013 citywide GHG emissions. City government GHG emissions have decreased by 12.8 percent relative to FY 2006 levels.

Most of these reductions were achieved early on, largely as a result of power plants switching their fuel source from carbon-intensive coal to natural gas – a less carbon-intensive energy source; and through the construction of new, highly efficient natural gas power plants, both within and outside the city. Prior to 2013, electricity use has historically been the largest source of GHG emissions within the city. This has been replaced by natural gas, which now contributes 34 percent of the citywide GHG emissions. The fall in electricity's contribution to overall GHG emissions illustrates the gains in both the cleanliness of the power supply, and increases in energy efficiency for electricity generation and its end use.

Analysis

Fig. 10: 2005-2014 Heating Degree Days, City-wide Heating Fuel Source Energy and GHG Emissions, Indexed to 2005



Source: NYC Mayor's Office

The greatest reductions in GHG emissions occurred prior to 2012. Since 2012 to present the rate of reduction has slowed and GHG emissions as reported in 2013 and 2014 are now more closely tracking the fall and rise of temperatures. GHG emissions now track very closely to the cold days of winter as a result of rising thermal demands and heating needs – measured in Heating Degree Days ("HDD").[3] This is especially evident in the 2014 GHG emissions inventory, as 2014 is the coldest year since 2005, as shown in Figure 10.

GHG emissions that result from increased use of energy to meet heating needs were offset in part by energy efficiency gains as a result of City programs and policies. Heating degree days decreased significantly from 2009 to 2012. Greenhouse gas emissions associated with fuel oil and natural gas show a somewhat consistent decrease aligned with this weather trend during this period. From 2012 to 2014 the cold winters of 2013 and 2014 are reflected in the upward slope of the HDD line, and while GHG emissions increase, they do not follow such a steep slope. This indicates that efforts citywide and in City government have helped to offset the even greater overall impact colder weather would otherwise have had on GHG emissions.

Table 1 below summarizes the overall results of the 2014 citywide GHG emissions inventory. Included there are 2014 GHG emissions totals for Scope 1, 2, and 3 emissions. Also included in Table 1 are sub-totals for each of the GHG emissions sources (by sector),

Table 1. 2014 Citywide GHG Emissions Inventory Results: By Source/Sector and GHG Emissions Scope

GHG Emissions Source (By Sector)	Total GHGs ($MtCO_2e$)			
	Scope 1	Scope 2	Scope 3	Total
Stationary Energy	20.71	15.21	-	35.92
Transportation	9.68	0.83	-	10.51
Waste	2.97	-	2.37	2.66
Total	**30.69**	**16.03**	**2.37**	**49.09**

Source: NYC Mayor's Office

Introduction

The City of New York, a global leader in carbon accounting, is fully compliant with the Compact of Mayors and the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) BASIC level.

The City released its first comprehensive greenhouse gas inventory in April 2007 (2005 Inventory), which formed both the citywide and City government greenhouse gas mitigation efforts and established the levels from which the City's greenhouse gas mitigation goals are based. Local Law 22 of 2008 requires the City to update both the citywide and City government inventories annually and to document the progress the City is making toward achieving its greenhouse gas mitigation goals.

The City of New York has become a global leader in the development and implementation of carbon accounting methodologies. The Mayor's Office of Sustainability has represented the City and municipal governments in general on steering and advisory committees responsible for developing standards for regional, national, and international carbon accounting and mitigation tracking methodologies and approaches. Each year the GHG Inventory has evolved to incorporate new and emerging carbon accounting procedures. Past year's inventory results are revised accordingly. As such, both the citywide and City government base year and interim year inventory results have been updated where applicable, reflecting both current methodologies and better data, and also allowing for more accurate comparability across multiple years. The reliance on increasingly rigorous analysis to measure the City's progress toward its GHG mitigation goal and inform policy efforts demonstrates its understanding of the critical importance of reliable, consistent, and complete GHG emissions accounting.

Recognizing the important role cities play in combating climate change and in an effort to work collaboratively with other cities around the globe, the City of New York became fully compliant with the Compact of Mayors, a global cooperative effort among mayors and city officials to reduce GHG emissions, track progress, and prepare for the impacts of climate change. The City has committed to working with cities across the globe and to use consistent best practices in GHG emissions accounting in a shared effort to track progress toward climate mitigation goals, including following the guidance of the GPC. The 2014 GHG emissions inventory is GPC BASIC level compliant.

Methodology

Citywide GHG emissions are calculated and reported per the guidance of the GPC. The GHG inventory consists of all direct and indirect GHG emissions from energy used by buildings and other stationary sources, and natural gas distribution within New York City; on-road transportation, railways, marine navigation, and aviation within the geographic borders of New York City; and GHG emissions from wastewater treatment, in city landfills, and solid waste disposed out of the city. These sources represent the GPC BASIC level of reporting, the level that is used to track the City's GHG mitigation goals.

City Government GHG emissions are calculated and reported per the Local Government Operations Protocol (LGOP).[2] The City Government inventory reports GHG emissions from operations, facilities, and sources either wholly owned by the City, or over which the City has full authority to introduce and implement operations, health and safety, and environmental policies (including both GHG- and non-GHG-related policies). GHG emissions from leased real estate and vehicles and other equipment are included. It is important to note that additional non-City operated public entities (e.g., MTA) are not included by this definition of operational control.

Detailed methodology descriptions for both Citywide and City Government GHG emissions are included in Appendix A.

Uncertainty

A greenhouse gas inventory is both an accounting and scientific exercise, and uncertainty exists in both data collection and aggregation and the calculation of GHG emissions. Uncertainty is inherently part of GHG calculations, as the development of emission factors and global warming potentials both involve scientific uncertainty. Uncertainty also is a part of the modeling and estimating necessary to complete GHG inventories. While a precise margin of error has not been calculated for this GHG inventory, it is understood that all results have some uncertain elements and should be interpreted and used accordingly.

Citywide Inventory

Citywide GHG emissions were 11.7 percent lower in 2014 than 2005. Activities in New York City resulted in the emission of 49.1 $MtCO_2e$ in 2014. GHG emissions increased in 2014 compared to 2013 by 1.0 percent.

The citywide GHG inventory consists of all direct and indirect GHG emissions from energy used by buildings and other stationary sources, and fugitive natural gas within New York City; on-road transportation, railways, marine navigation, and aviation within the geographic borders of New York City; and GHG emissions from wastewater treatment, and in-city landfills, and solid waste disposed of out of the city.

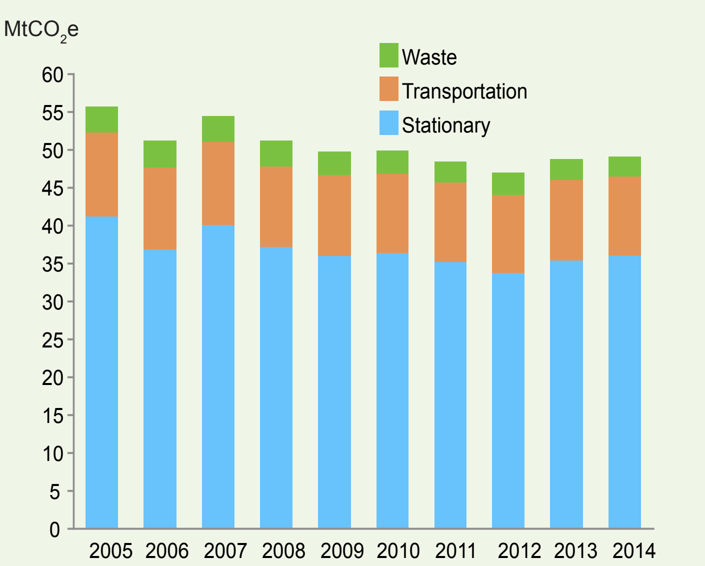
- Scope 1 GHG Emissions: 30.7 $MtCO_2e$ (direct emissions from on-site fossil fuel combustion or fugitive emissions from within the city's boundary)

- Scope 2 GHG Emissions: 16.0 $MtCO_2e$ (indirect emissions from energy generated in one location, but used in another, such as electricity and direct steam).

- Scope 3 GHG emissions included in the city's total emissions results: 2.4 $MtCO_2e$ (indirect emissions that occur outside the city's boundary as a result of activities within the city's boundary, e.g., emissions from exported solid waste).

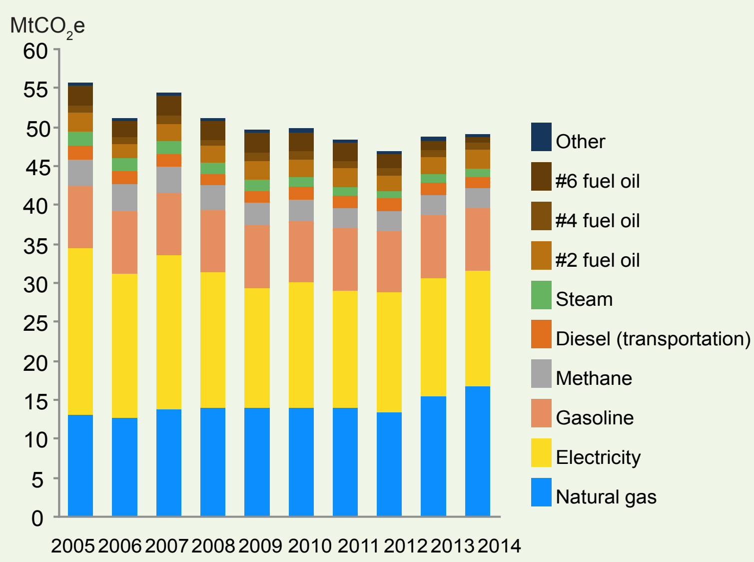
Figure 11 below presents the citywide annual GHG emissions over the 2005-2014 time period, with GHG emissions reported by Sector, as according to the GPC sector definitions for stationary energy, transportation and waste.

Fig. 11: Citywide Annual GHG Emissions by Sector, 2005-2014



Source: NYC Mayor's Office

Fig. 12: Citywide Annual GHG Emissions by Source, 2005-2014



* Other : jet fuel from aviation, CH_4 and N_20 from compostimg, CO_2e from waste incineration

Source: NYC Mayor's Office

Figure 12 above presents the citywide annual GHG emissions over the 2005-2014 time period, with GHG emissions reported by the following source types:

- Heating oil
- Electricity
- Natural gas
- Steam
- Gasoline
- Diesel (transportation fuel)
- Fugitive waste
- Other

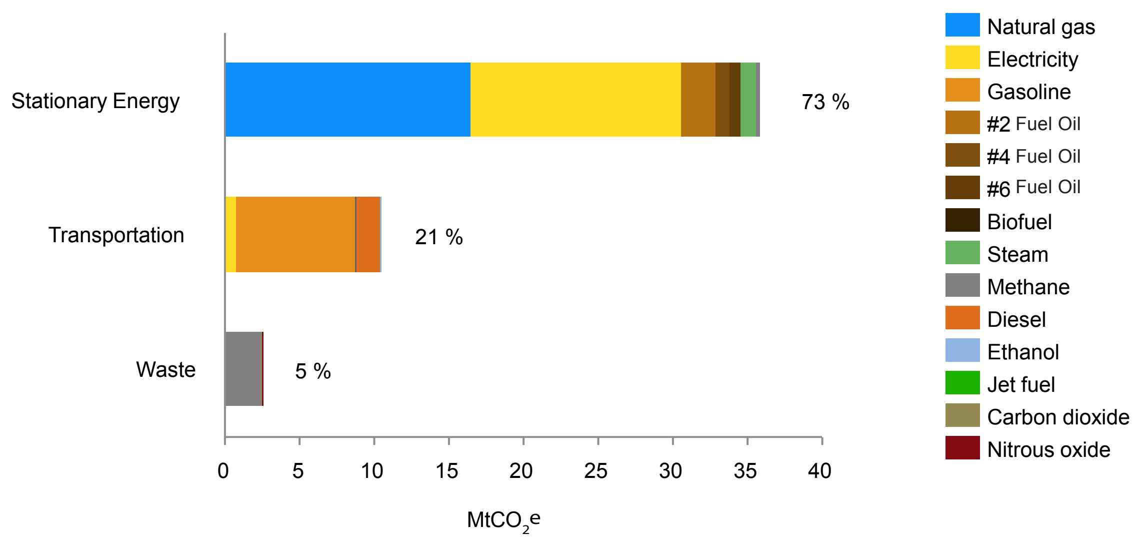
Figure 13 provides additional details on the 2014 citywide GHG emissions inventory. Shown are the overall contributions to the citywide GHG inventory both by the various sectors, i.e., Stationary, Transportation, and Waste, and by the individual energy/emissions source type. Stationary Energy emissions are by far the dominant sector of the

GHG Accounting Scopes

New York City's GHG inventory follows standard international conventions for municipal GHG emissions reporting. The City's inventory includes Scope 1 emissions from buildings and industrial facilities within the city, vehicles operated within the city, and solid waste and wastewater managed within the city; Scope 2 emissions from electricity and steam used in buildings, industrial facilities, streetlights, and transit systems within the city; and Scope 3 emissions from solid waste generated within the city but disposed of outside of the city's boundary. GHG accounting practice has historically classified emissions by "Scopes" per the World Resources Institute/World Business Council for Sustainable Development's Greenhouse Gas Protocol, the world's corporate GHG accounting standard and the standard upon which many other GHG accounting protocols are based, including the GPC. Following the GPC guidance, New York City defines Scopes as:

- Scope 1: Direct emissions from on-site fossil fuel combustion or fugitive emissions from within the city's boundary.
- Scope 2: Indirect emissions from energy generated in one location, but used in another, such as district electricity and district steam use.
- Scope 3: Indirect emissions that occur outside the city's boundary as a result of activities within the city's boundary, e.g., emissions from exported solid waste. Examples of Scope 3 emissions that are not included in New York City's inventory include emissions from extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services. New York City's current GHG inventory includes all Scope 1 and Scope 2 emissions, and includes Scope 3 emissions from solid waste generated within the city's boundary but disposed of outside of the city. The City may revise its GHG reporting approach to include additional sources (including consumption-based emissions) as applicable GHG protocols evolve.

Fig. 13: 2014 NYC Citywide GHG Emissions by Sector and Source



Source: NYC Mayor's Office

citywide 2014 GHG inventory, contributing over 73 percent of the total citywide GHG emissions, with natural gas contributing approximately 34 percent of the total, and electricity approximately 30 percent of the total.

Citywide GHG emissions changes from 2005 to 2014:

- Citywide GHG emissions were 11.7 percent lower in 2014 than 2005.
- Biofuel use in buildings increased significantly, by a factor of over 150, now representing almost 3 percent of the total heating fuel oil market, while the overall total use of regular fuel oils has decreased by 30 percent.
- Reduction in the use of #6 fuel oil resulted in a 73 percent decrease in its GHG emissions.
- Emissions from steam decreased by 43 percent, equivalent to 0.83 MtCO2e.
- Natural gas used in buildings increased 27 percent since 2005, and is now the largest source of GHG emissions in New York City at 33.6 percent. GHG emissions from natural gas were 16.5 MtCO2e.
- Electricity is responsible for 30.4 percent of citywide GHG emissions (with 28.7 percent coming from buildings, and 1.7 percent from subways and commuter rail).

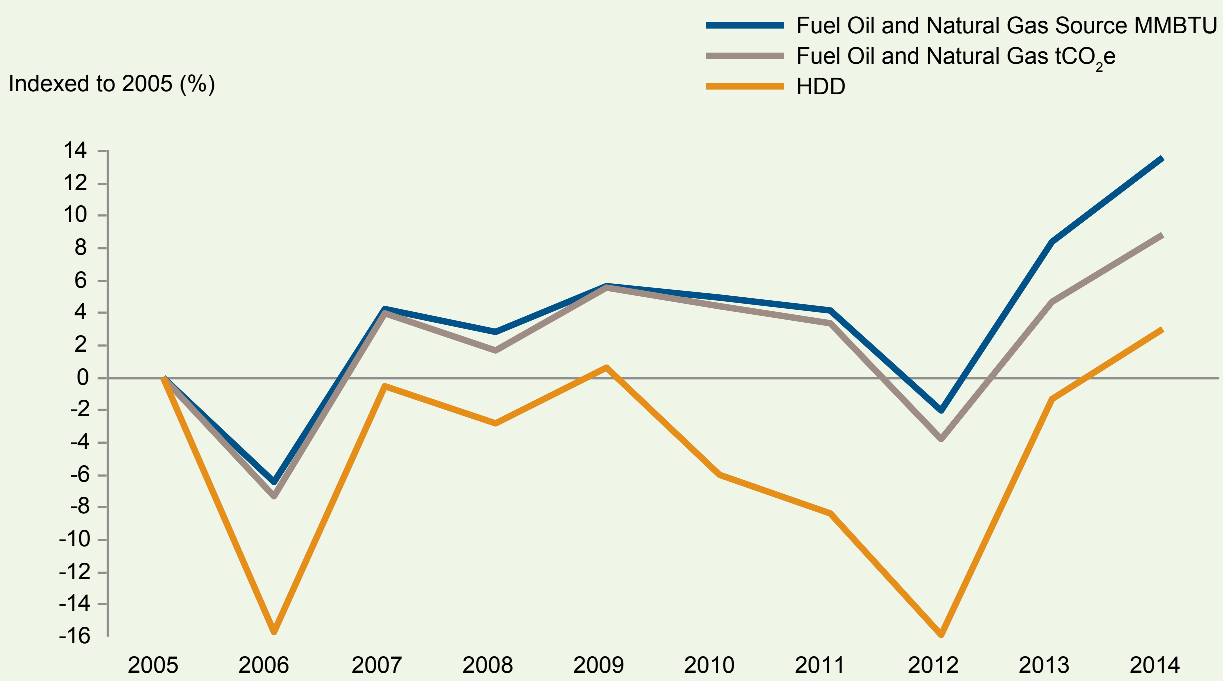
Citywide GHG emissions changes from 2013 to 2014:

- GHG emissions in 2014 were 1.0 percent greater than in 2013, at 49.1 MtCO2e.
- A key driver contributing to changing emissions during the 2013-2014 time period was an even colder winter, with 2014 experiencing about a 4 percent increase in heating degree days over 2013, which itself had experienced a very cold winter.

Influence of Weather

The major driver behind the increase in GHG emissions observed in 2014 is the weather. Figure 14 shows GHG emissions plotted against the number of heating degree days (HDD) for citywide results. Heating degree days approximates space heating needs within a building and is a proxy for the impact of cold winter weather on the energy needed to heat buildings. It is defined as the number of degrees that a day's average temperature is below 65 degrees Fahrenheit (18 degrees Celsius), the temperature below which buildings need to be heated. The number of heating degree days within the calendar year (January 1 to December 31) are used within the citywide analysis.

Fig. 14: 2005 to 2014 HDD Citywide Heating Fuel Source Energy and GHG, Indexed to 2005



Source: NYC Mayor's Office

As shown in Figure 14, citywide heating fuel GHG emissions consistently tracked heating fuel GHG from 2007 to 2012. Heating degree days decreased significantly from 2009 to 2012, when the city experienced the warmest winter since 2005. Greenhouse gas emissions show a somewhat consistent decrease aligned with this weather trend during this period. From 2012 to 2014 the cold winters of 2013 and 2014 are reflected in the upward slope of the HDD line, and while GHG emissions increase, they do not follow such a steep slope. This provides evidence indicating that efforts citywide and in City government have helped to offset the even greater overall impact colder weather would otherwise have had on GHG emissions. In addition, total source energy for natural gas and fuel oil is increasing at a steeper slope than GHG emissions from these sources, demonstrating that the carbon intensity of heating fuel has decreased due to fuel switching from oil to natural gas.

Citywide methodology for analysis of change

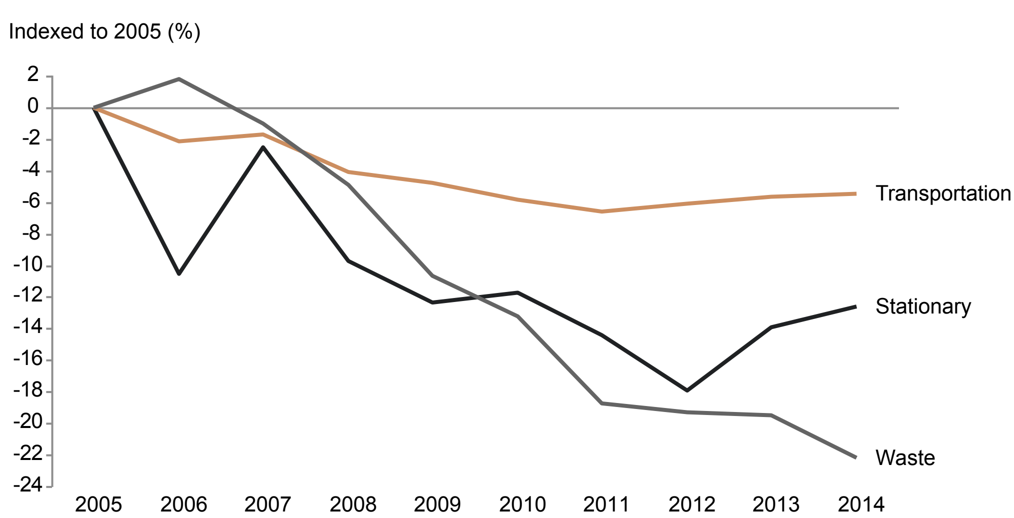
The City calculated changes in GHG emissions and energy use in each sector to determine how factors driving changes, such as growth, weather, and changes in carbon intensity of the city's electricity and steam supply affect GHG emissions. The change in population was applied to all non-building emission sources, while the change in building floor area was applied to building sector emissions sources to determine the collective net impact these factors had on GHG emissions.

The City conducted regression analyses for each building energy source using data on monthly energy use and heating degree and cooling degree days to determine the correlation of weather to building energy use. This correlation was used to calculate the change in energy use beyond that resulting from changes in weather. The results of this analysis determined the expected use of electricity, fuel oil, natural gas, and steam for each year, which were divided by the use of each energy source in the earlier year for each period to determine a weather impact factor.

This factor was then multiplied by the building's energy use for each source to determine the impact weather had on the use of building energy use (due to data availability, City government steam and fuel oil use was used as a proxy for citywide use). The results of regression analyses for electricity, natural gas, steam, and fuel oil are shown in Appendix D (Weather Impacts on GHG Emissions).

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

Fig. 15: Changes to Citywide GHG Emissions, 2005-2014, Indexed to 2005



Source: NYC Mayor's Office

Each year, New York City reviews past years' GHG inventory results and makes adjustments where needed based on a number of factors. This year, several revisions were made that affected past citywide and City Government GHG reported emissions. Revised activity data, new vehicle miles traveled modeling, updated electricity and steam emissions factors, revised combustion fuel GHG emission factors, and updated global warming potentials all played a role in these revisions. Details of these revisions are reported in Appendix A.

Changes to citywide emissions

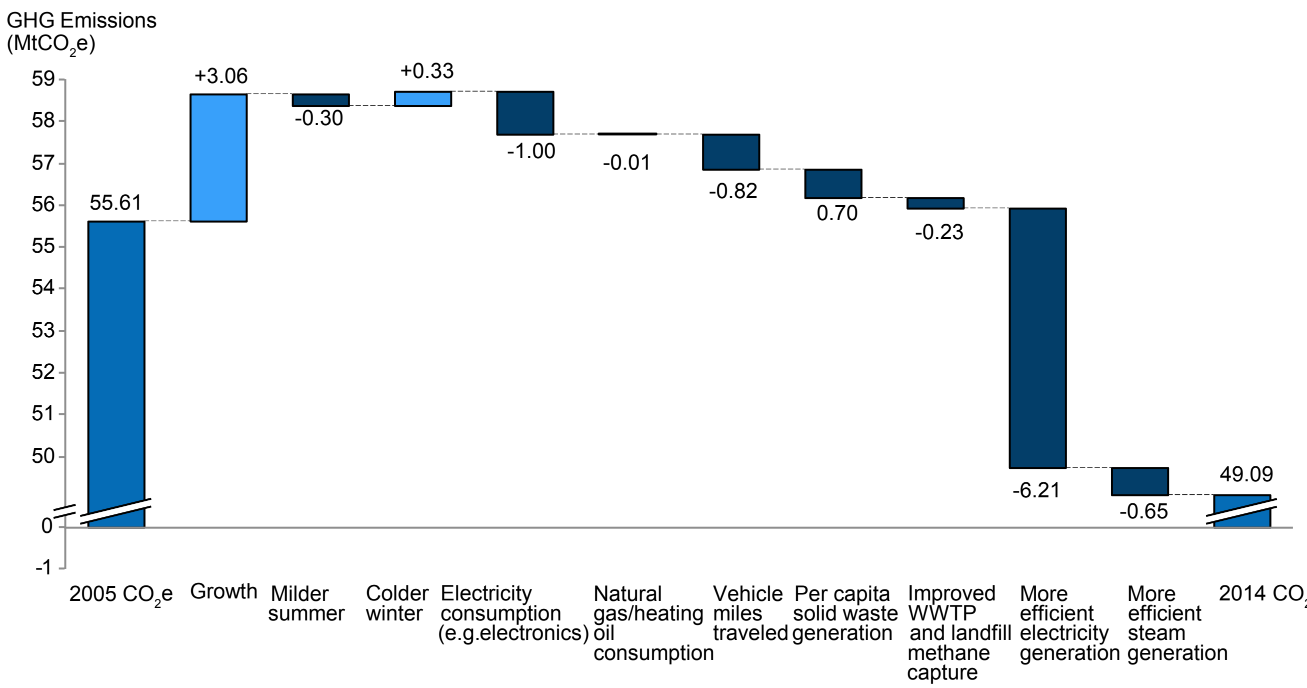
The City assessed factors that might affect inter-annual changes to citywide GHG emissions. Certain factors, such as weather, population growth, increased building floor area, and changes to the carbon intensity of electricity and steam generation, are external factors beyond the City's control. However,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

2005-2014 Changes

Figure 15 illustrates the overall, long-term GHG emissions trends and annual changes for each of the three (3) GPC reporting sectors: Stationary, Transportation, and Waste.

Over the entire 2005-2014 time period, the citywide drivers for changes in emissions were analyzed, as described previously, and these results are summarized in Figure 16 below.

Fig. 16: Citywide 2005 to 2014 CO_2e Emissions Drivers



Source: NYC Mayor's

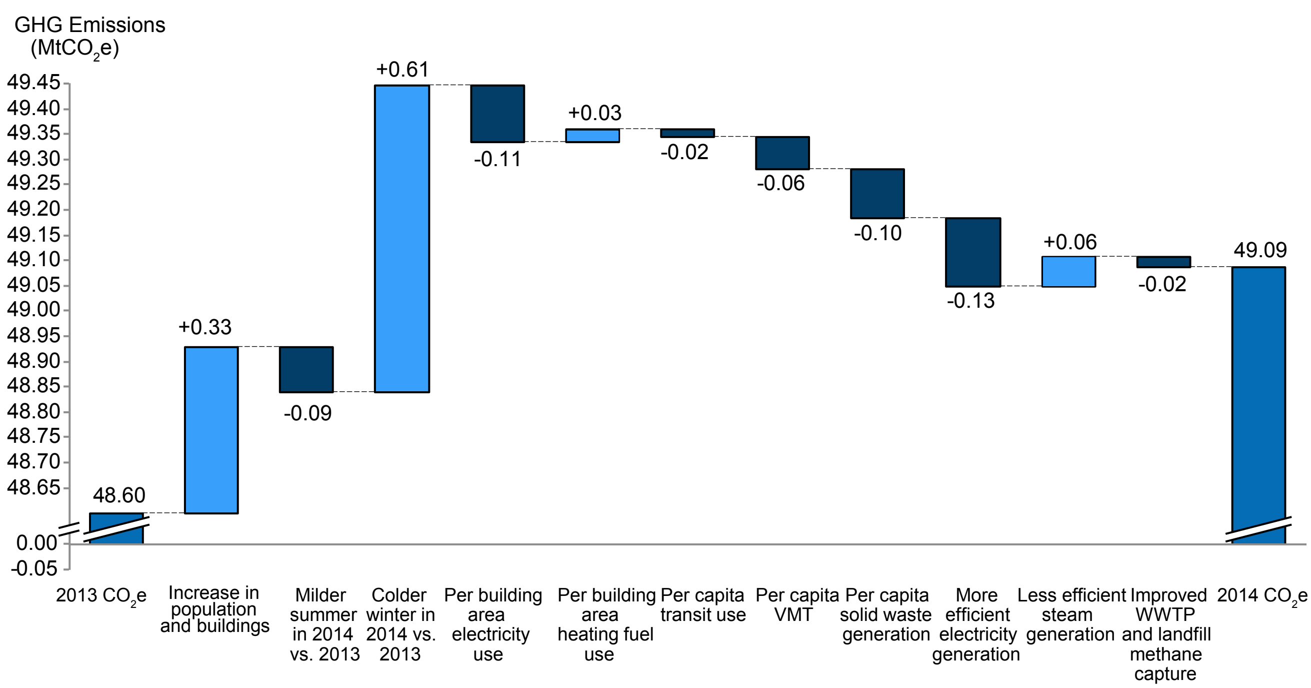
Citywide GHG emissions were 11.7 percent lower in 2014 than in the 2005 base year. Overall colder winter weather and growth in building area increased GHG emissions, particularly over the last couple years; however, this was offset by a number of factors. Lower carbon intensity and more efficient electricity generation have played the most significant role in GHG emissions reductions. Additionally, many other factors have also played a role in reducing GHG emissions, including: improved on-road vehicle fuel economy, decreased per building area electricity and heating fuel use, and improved steam generation efficiency.

As Figure 16 shows, overall milder summer, reduced energy use per unit of building floor area, reduced carbon intensity of electricity and steam generation, reduced per capita vehicle use, and reduced solid waste generation were responsible for most of this long-term GHG emissions reduction. If weather, building and population growth, and electricity and steam generation carbon intensity are excluded, overall GHG emissions decreased in this period by approximately 5 percent.

2013-2014 Changes

A similar analysis of emissions drivers was also performed for the year-on-year changes from 2013 to 2014. The results of that analysis are shown in Figure 17 below. Figure 17 clearly shows the effects of a colder winter in 2014 (producing a 0.61 Mt CO_2e emissions increase over 2013), and population and building growth (producing a 0.33 Mt CO_2e emissions increase over 2013). These two effects combined to produce a 1.9 percent increase in total citywide GHG emissions in 2014, compared to 2013. All of the other emissions drivers collectively combined to limit the total net increase in citywide GHG emissions in 2014 to 1.0 percent over the 2013 GHG emissions level.

Fig. 17: Citywide 2013 to 2014 CO_2e Emissions Drivers



Source: NYC Mayor's

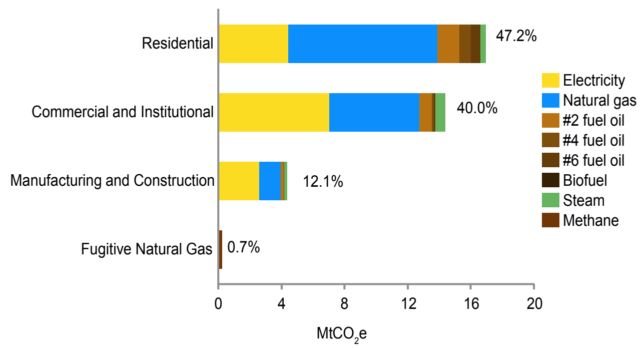
Citywide GHG Emissions by Sector

Stationary Energy

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

From 2005 to 2014 GHG emissions from citywide stationary energy used in buildings and facilities decreased by 12.6 percent or 5.2 MtCO_2e. Less carbon intensive electricity did play the most significant role in driving down emissions.

Fig. 18: 2014 NYC Citywide Stationary Energy GHG Emissions by Source



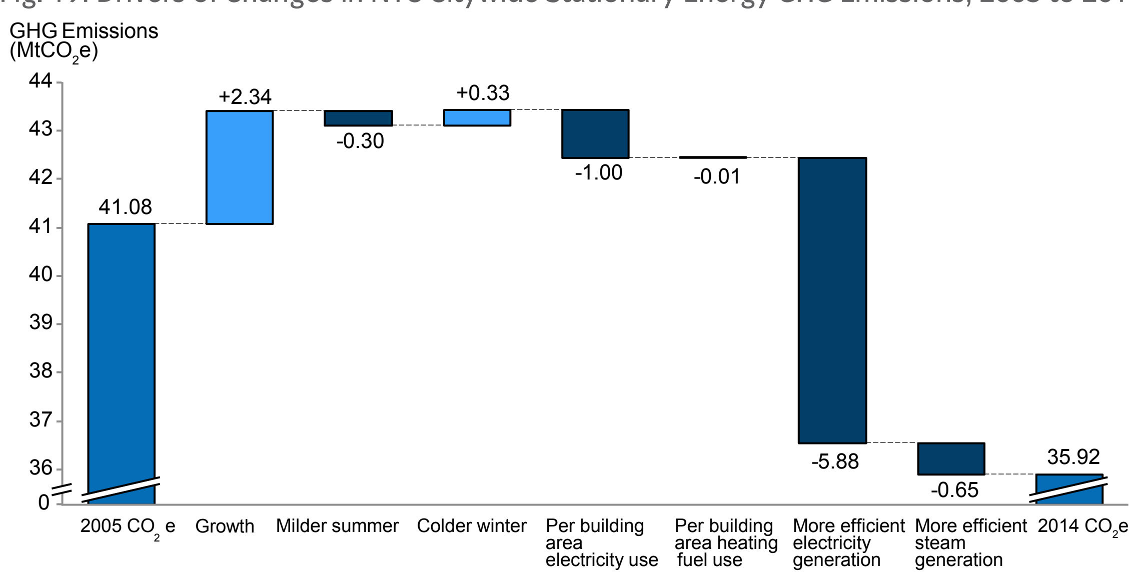
Source: NYC Mayor's Office

Note that GHG emissions from natural gas increased by 3.46 MtCO_2e. This evidence of increased natural gas use is due to the very cold winters of 2013 and 2014; the construction of new buildings, which typically use natural gas; and to the City's Clean Heat Program, which is designed to phase out the use of heavy heating oil, or #6 oil. Thus, while natural gas emissions rose, the net environmental effect was positive in that the wider use of gas caused the burning of more highly polluting oil to decline.

Figure 18 presents additional details on the 2014 citywide GHG Inventory's Stationary Energy GHG emissions by source type. Figure 18 shows that natural gas had the largest contribution to Stationary Energy GHG emissions with approximately 46 percent of the total, followed by electricity with approximately 39 percent, and heating oil (#2, #4, and #6 combined) with approximately 11 percent.

Over the entire 2005-2014 time period, the citywide drivers for changes in Stationary Energy GHG emissions were analyzed, and these results are summarized in Figure 19 . As Figure 19 shows, cleaner and more efficient electricity generation, increased electricity use efficiency per building area, and milder summer weather were responsible for most of this long-term GHG emissions reduction in Stationary Energy. These drivers for changes in GHG emissions more than offset the significant growth in population and buildings, and the somewhat colder winter in 2014 than that in 2005, resulting in a net 13 percent decrease in Stationary Energy GHG emissions over that time period.

Fig. 19: Drivers of Changes in NYC Citywide Stationary Energy GHG Emissions, 2005 to 2014

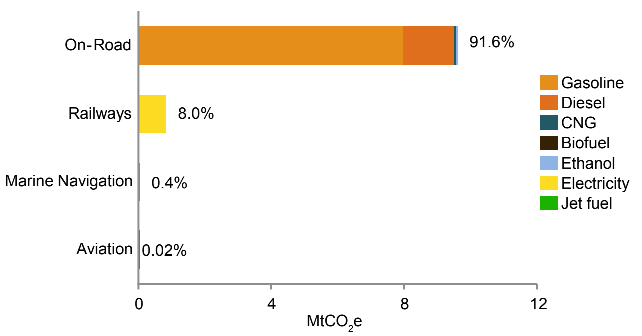


Source: NYC Mayor's Office

Citywide GHG Emissions by Sector

Transportation

Fig. 20: 2014 Citywide Transportation GHG Emissions by Source



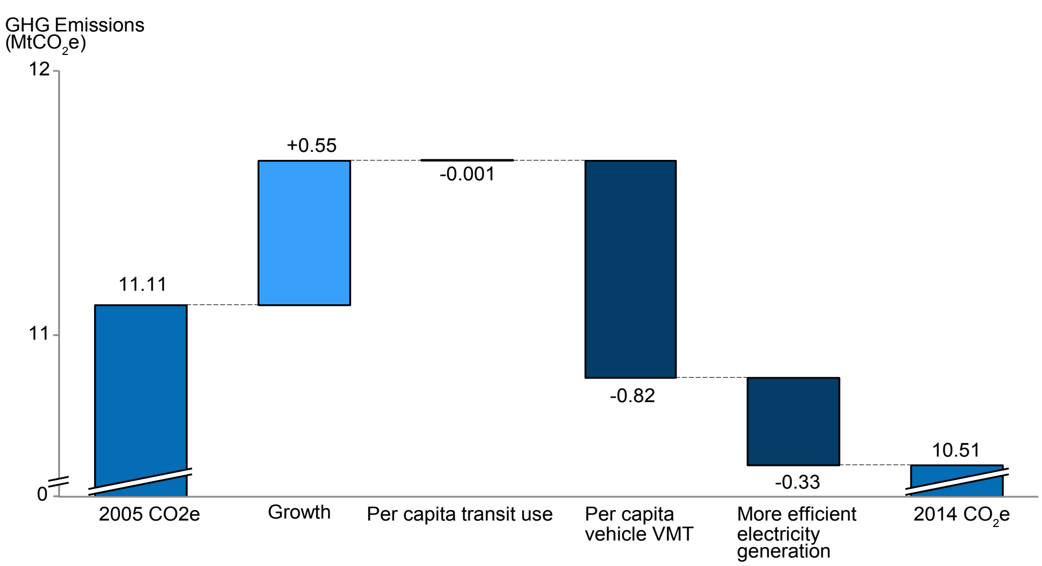
Source: NYC Mayor's Office

New York City has one of the world's most extensive mass transit systems in the world, with subways, buses, commuter railways, and ferries contributing materially to the city's low per capita GHG emissions levels. The city is also home to more than two million vehicles, the operation of which accounted for 20 percent of the city's total GHG emissions in 2014. Transportation sources resulted in 10.5 $MtCO_2e$ GHG emissions in 2014. This is a 0.2 percent increase from total transportation emissions in 2013. Reduced carbon intensity of the electricity supply serving the city's subways and commuter trains was the largest driver for transportation emission reductions. Since 2005, the fuel economy of the city's light truck fleet (sport utility vehicles and pick-up trucks) decreased slightly. The city's subway and commuter rail system used approximately 5.5 percent of all electricity used in the city in 2014. As such, the large decrease in the carbon intensity of the city's electricity supply over the last ten years led to a reduction of 0.33 $MtCO_2e$, after accounting for the impact of population growth. Per capita transit use also increased slightly during this time, leading to an increase in GHG emissions from transit-related sources.

Figure 20 above presents additional details on the 2014 citywide GHG inventory's Transportation GHG emissions by source type. Figure 20 shows that gasoline is by far the largest contributor to Transportation GHG emissions with approximately 76 percent of the total, followed by diesel with approximately 15 percent, and electricity with approximately 8 percent.

Figure 21 shows the citywide drivers for changes in Transportation GHG emissions over the entire 2005-2014 time period. The significant decrease in per capital vehicle miles traveled (VMT), along with the effects of cleaner and more efficient electricity generation (reducing subway and commuter rail GHG emissions), combined to more than offset the increase in Transportation GHG emissions associated with population growth over the 2005-2014 time period. This resulted in a net 5 percent reduction in Transportation GHG emissions, and corresponds to an overall reduction of approximately 1.1 percent of the total citywide 2005 base year emissions.

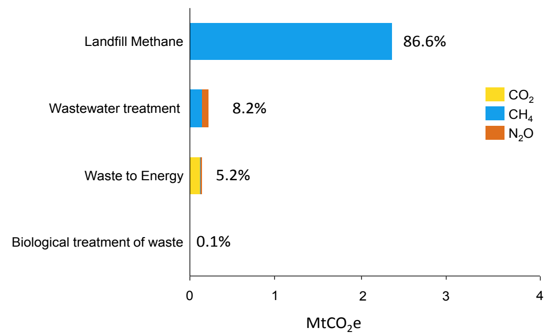
Fig. 21: Drivers of Changes in NYC Citywide Transportation GHG Emissions, 2005 to 2014



Source: NYC Mayor's Office

Waste

Fig. 22: 2014 NYC Citywide Waste GHG Emissions by Source



Source: NYC Mayor's Office

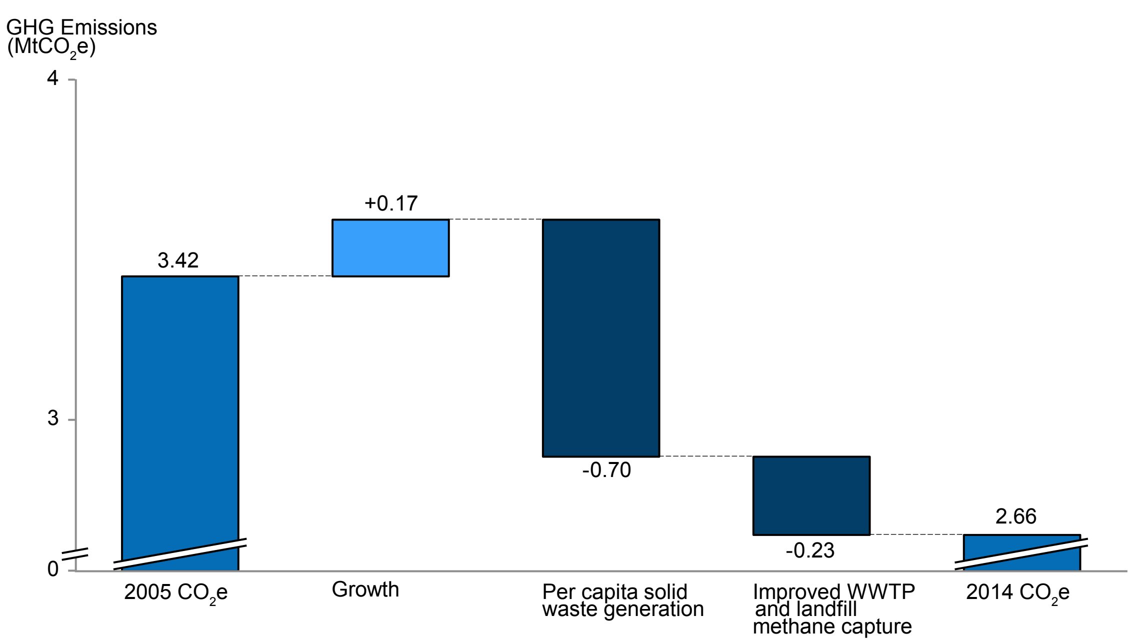
New York City's residents, workers, and visitors generate more than 20,000 tons of solid waste and use more than 1 billion gallons of water each day. The management of this solid waste and treatment of wastewater was responsible for 2.66 $MtCO_2e$ of fugitive CO_2, methane (CH_4), and nitrous oxide (N_2O) in 2014.

As New York City's six in-city landfills are closed and no longer accepting solid waste, methane generation from these facilities is steadily decreasing as the waste decomposes. The City is seeking to reduce the volume of solid waste it sends to landfills by 90 percent by 2030.

Figure 22 presents additional details on the 2014 citywide GHG inventory's Waste GHG emissions by source type. Figure 22 shows that methane is the dominant Waste GHG emissions source type, contributing over 92 percent of the total (with over 90 percent of that coming from landfills), followed by CO_2 with approximately 5 percent.

Figure 23 shows the citywide drivers for changes in Waste GHG emissions over the entire 2005-2014 time period. The significant decrease in per capita solid waste generation (due in part to increased recycling and composting rates), along with improved methane capture at both landfills and wastewater treatment plants, more than offset the increase in Waste GHG emissions associated with population growth. This results in a net 22 percent reduction in Waste GHG emissions over the 2005-2014 time period, and corresponds to an overall reduction of approximately 1.4 percent of the total citywide 2005 base year GHG emissions.

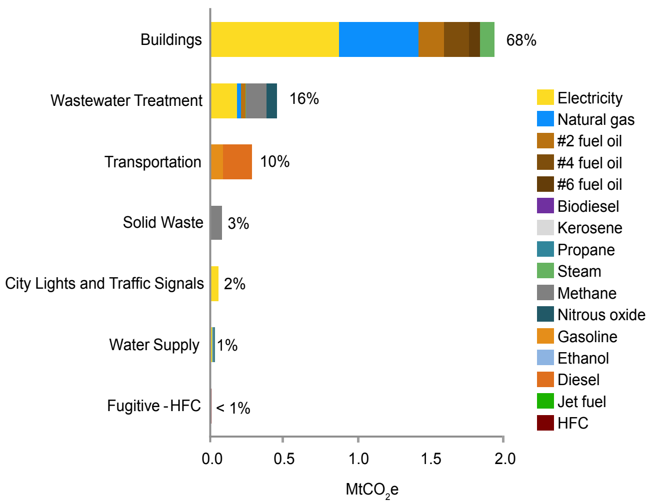
Fig. 23: Drivers of Changes in NYC Citywide Waste GHG Emissions, 2005 to 2014



Source: NYC Mayor's Office

City Government Inventory

Fig. 24: FY 2014 City Government GHG Emissions by Sector and Source



Source: NYC Mayor's Office

City government emissions were 12.8 percent lower in FY 2014 than FY 2006. However, resulting primarily from a colder winter in FY 2014, emissions increased 1.9 percent from FY 2013 to FY 2014. Despite that increase, significant strides were made. For example, the use of highly polluting #6 fuel oil decreased by 34 percent from FY 2013 to FY 2014, and 64 percent over the entire FY 2006 – FY 2014 time period, in response to the local law phase out of heavy fuel oils. Also, the use of gasoline used in vehicle fleet decreased by 10 percent from FY 2013 to FY 2014, and by 23 percent over the entire FY 2006 to FY 2014 time period

New York City's government uses large amounts of energy each year to provide services to millions of city residents, businesses, commuters, and visitors. The city's municipal buildings, wastewater treatment plants (WWTPs), and vehicle fleet are responsible for the majority of City government GHG emissions, while landfills, the transportation of solid waste, operation of streetlights and traffic signals, and the water supply system account for the remainder. This New York City government GHG inventory is calculated and reported in accordance with the Local Government Operations Protocol (LGOP) and reports GHG emissions from operations, facilities, or sources wholly owned by the City or over which the City has full authority to introduce and implement operations, health and safety, and environmental policies (including both GHG- and non-GHG-related policies) . GHG emissions from leased real estate and vehicles and other equipment are included. It is important to note that additional non-City operated public entities (e.g., the Metropolitan Transportation Authority) are not included by this definition of operational control.

City Government FY 2014

New York City's government GHG emissions were 3.14 $MtCO_2e$ in FY2014, resulting in a 1.9 percent increase from FY 2013. This corresponds to a 12.8 percent decrease from FY 2006 base year levels. FY 2014 GHG emissions are broken down as follows:

Scope 1 GHG emissions: 1.78 $MtCO_2e$ (direct emissions from on-site fossil fuel combustion or fugitive emissions from within the city's boundary).

Scope 2 GHG emissions: 1.36 $MtCO_2e$ (indirect emissions from energy generated in one location, but used in another, such as electricity and direct steam.

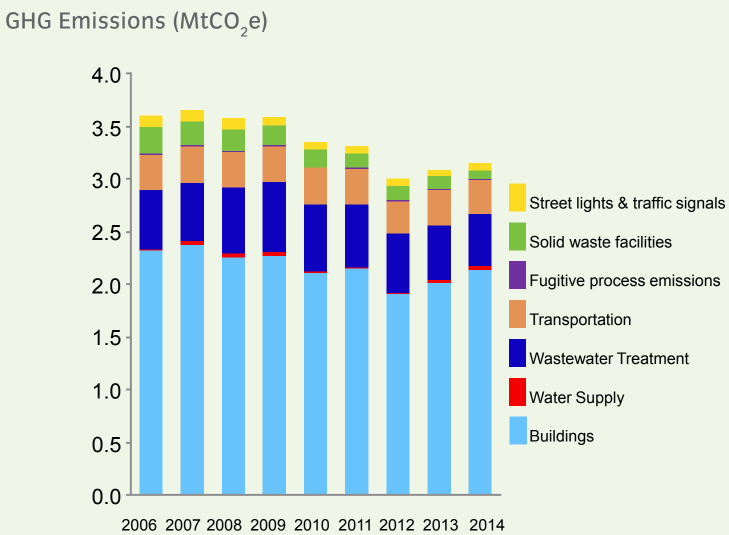
The city government GHG emissions are shown in Figure 24 below, broken down into water supply, wastewater treatment, buildings, streetlights, solid waste methane and transportation. Buildings are the largest contributor to City government operations' GHG emissions at 68 percent, with Wastewater Treatment and Transportation contributing at 16 percent and 10 percent of the City government total, respectively.

Figure 25 below shows City government GHG emissions from FY 2006 to FY 2014, by municipal sector. City government GHG emissions have decreased significantly in comparison to the FY 2006 base year, with FY 2014 GHG emissions being 12.8 percent less than FY 2006 GHG emissions. Figure 25 further illustrates that the very cold winters of FY 2013 and FY 2014 had a significant effect on City government emissions, with FY 2014 GHG emissions being 1.9 percent higher than FY 2013 GHG emissions (and that being after an approximately 3 percent increase in emissions in FY 2013 over that of FY 2012). Figure 25 also shows that those increases were essentially all in the Buildings sector, based on thermal heating demands, as all other sectors generally continued their historical trends observed in FY 2012 and previously.

Figure 26 below presents the City government annual GHG emissions over the FY 2006 – FY 2014 time period, with GHG emissions reported by source. Electricity use is the largest contributor to FY 2014 City government GHG emissions with 40 percent of the City government total, followed by natural gas with 20 percent of the total, and fuel oil with 16 percent.

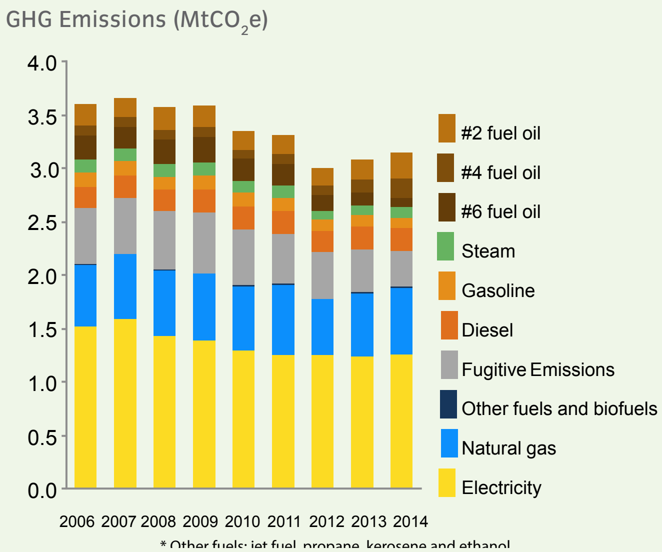
Although weather and growth in building floor area have influenced an increase in GHG emissions, City government operations have offset this increase. Cleaner electricity since FY 2006 was the largest single driver of GHG emissions reduction in the 2014 City government inventory. However, as of FY 2014, municipal operations and policy drivers now play a more significant role in overall GHG emissions reductions than electricity supply and utility operations. The City's more efficient use of electricity and heating fuel together have had a larger impact in reducing emissions than the improved efficiency of electricity

Fig. 25: FY 2006 to FY 2014 City Government GHG Emissions by Sector



Source: NYC Mayor's Office

Fig. 26: FY 2006 to FY 2014 City Government GHG Emissions by Source



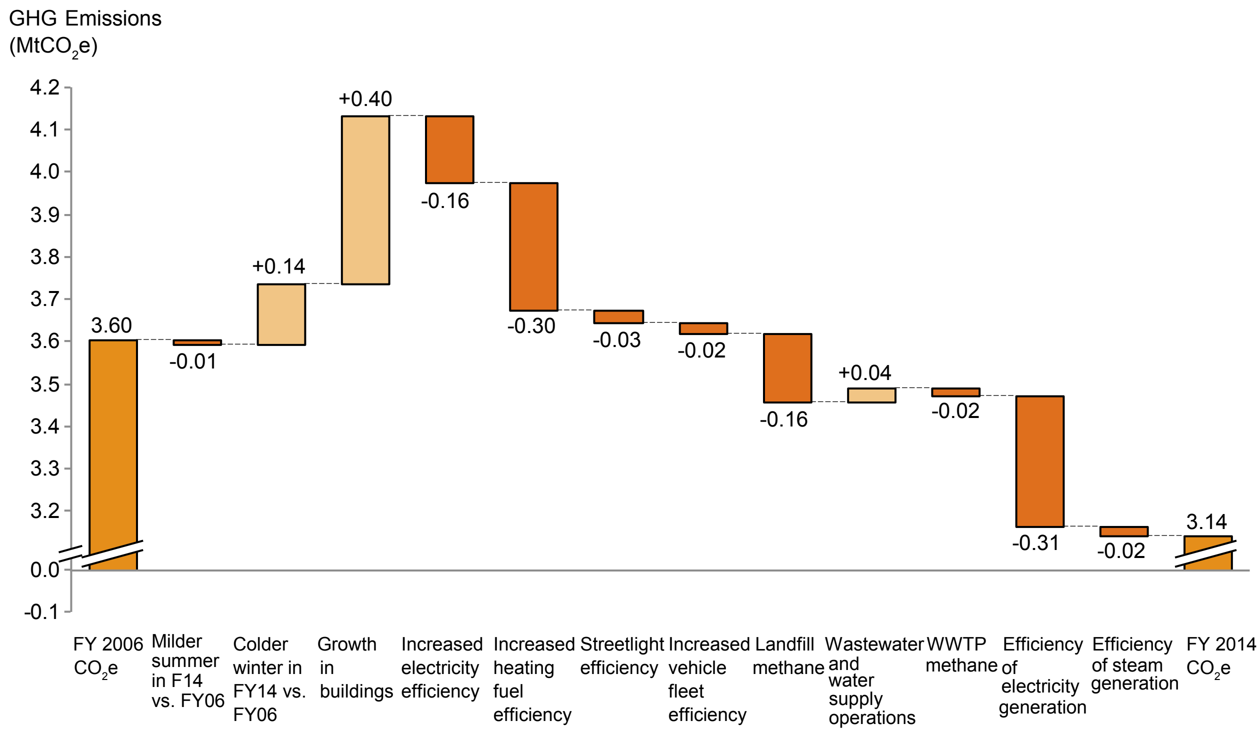
Source: NYC Mayor's Office

generation. The amount of methane produced from landfills within the City has also decreased significantly with time. Landfills within the City are now closed and as the waste decomposes the rate of methane generation steadily decreases. Streetlights also use less electricity through conversions to LED technology while maintaining their vital services. Transportation fleets have decreased GHG emissions through the adoption of alternative fuels, more fuel efficient vehicles, and fleet size reduction measures.

Over the entire FY 2006 – FY 2014 time period, the City government drivers for changes in emissions were analyzed (as described previously in the citywide analysis section), and these results are summarized in Figure 27. As Figure 27 shows, increased building heating fuel use efficiency and cleaner/more efficient electricity generation were the two largest drivers for GHG emissions reduction in City government, followed by increased electricity use efficiency and landfill methane emissions reductions. These City government GHG emissions reduction drivers more than offset the effects of increased building floor area and colder winter, resulting in a net 12.8 percent reduction in City government GHG emissions in FY 2014 from the FY 2006 base year emissions level.

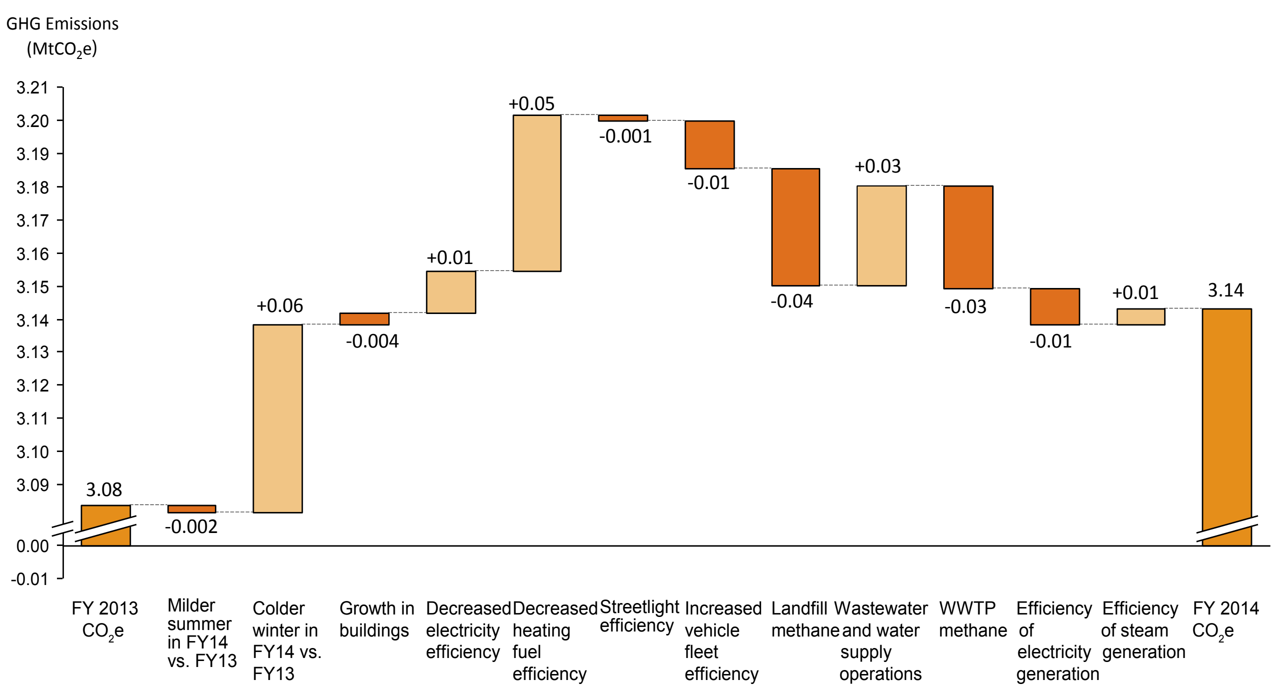
A similar analysis of emissions drivers was also performed for the year-on-year changes from FY 2013 to FY 2014; the results of that analysis are shown in Figure 28 below. Figure 28 clearly show the effects of a colder winter in FY 2014, producing a 0.06 $MtCO_2e$ emissions increase over FY 2013; and a reduction of heating fuel energy efficiency, producing a 0.05 $MtCO_2e$ emissions increase over FY 2013. These two effects combined to produce a 3.6 percent increase in total City government GHG emissions in FY 2014 compared to FY 2013. All of the other emissions drivers collectively combined to limit the total net increase in City government GHG emissions in FY 2014 to 1.9 percent over the FY 2013 emissions level.

Fig. 27: City Government FY 2006 to FY 2014 GHG Emissions Drivers



Source: NYC Mayor's Office

Fig. 28: City Government FY 2013 to FY 2014 GHG Emissions Drivers



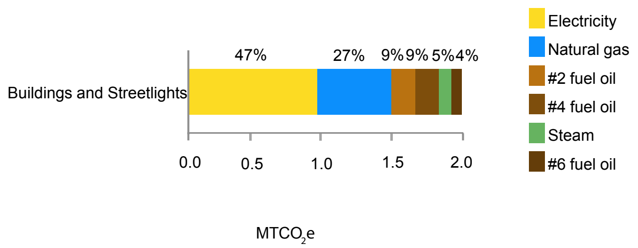
Source: NYC Mayor's Office

City Government GHG Emissions by Sector

Buildings

Figure 29 below presents the additional details on the FY 2014 City government GHG inventory's Buildings GHG emissions by fuel type. Figure 29 shows that electricity use was the largest source of GHG emissions with 47 percent of the total, followed by natural gas with 27 percent, and heating oil (#2, #4, and #6 combined) with 23 percent.

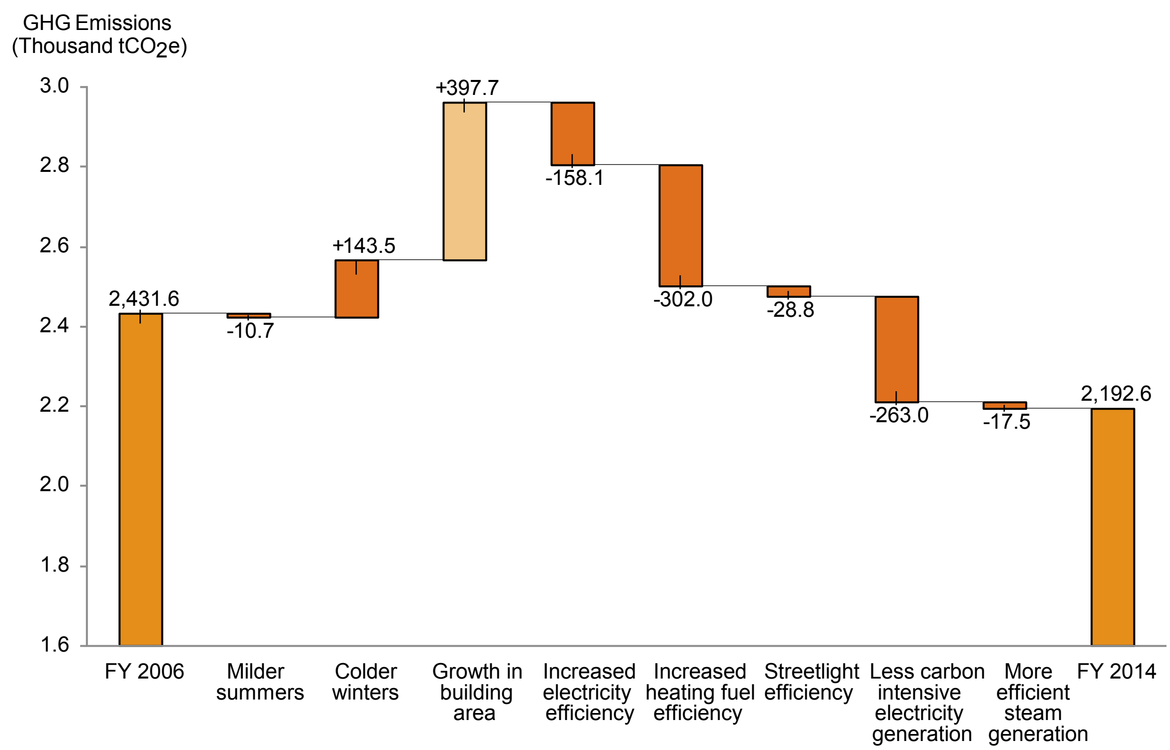
Fig. 29: FY 2014 City Government Buildings and Streetlights GHG Emissions by Source



Source: NYC Mayor's Office

Figure 30 below summarizes the City government drivers for change in Buildings and Streetlights GHG emissions, over the entire FY 2006 – FY 2014 time period. As Figure 30 shows, increased heating fuel use efficiency per building area, cleaner and more efficient electricity generation, and increased electricity use efficiency per building area were responsible for most of this long-term GHG emissions reduction in City government Buildings. These drivers for change in emissions more than offset the growth in buildings and the colder winter in FY 2014 than in FY 2006, resulting in a net 10 percent decrease in Building GHG emissions over this time period, corresponding to an overall 7 percent reduction in total City government GHG emissions from the FY 2006 base year GHG emissions level.

Fig. 30: Drivers of Changes in NYC City Government Buildings and Streetlights GHG Emissions

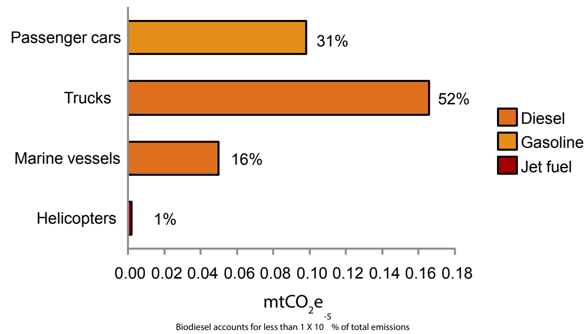


Source: NYC Mayor's Office

City Government GHG Emissions by Sector

Vehicle Fleet

Fig. 31: FY 2014 City Government Vehicle GHG Emissions by Source



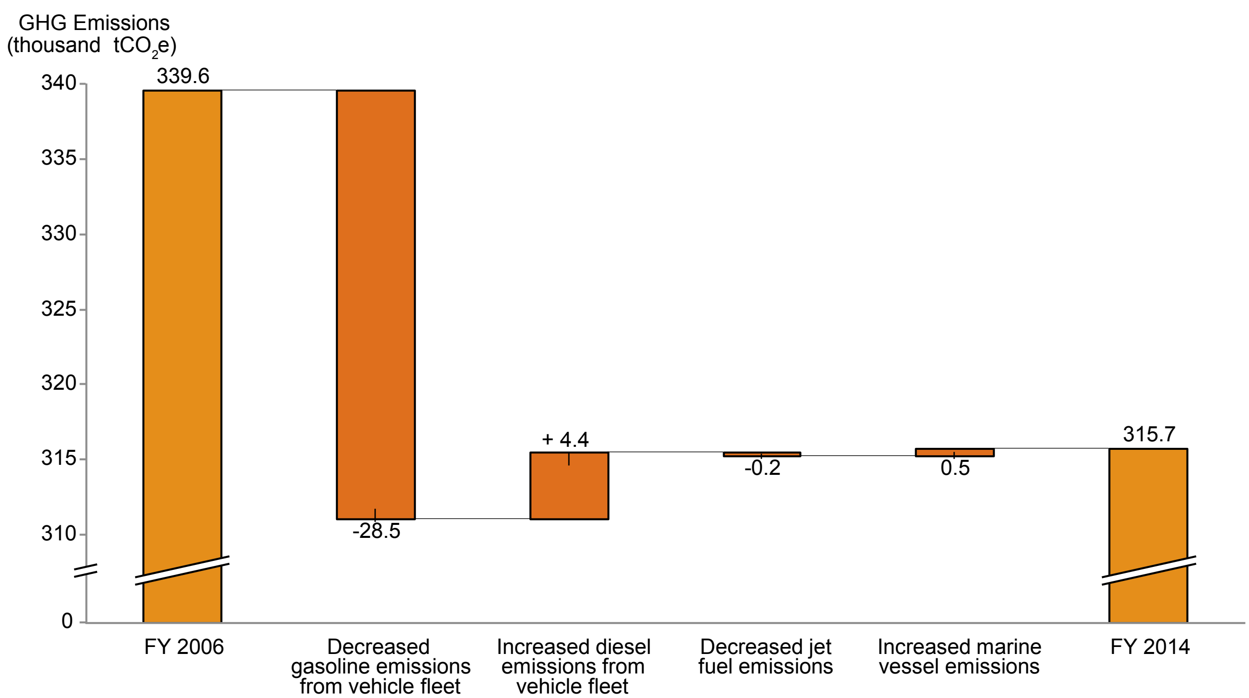
Source: NYC Mayor's Office

New York City operates the largest municipal vehicle fleet in the U.S. with over 28,000 fleet units. City government Vehicle Fleet sources resulted in 0.32 $MtCO_2e$ GHG emissions in FY 2014, representing approximately 10 percent of the total City government FY 2014 GHG inventory. This is an approximately 4 percent decrease from total Vehicle Fleet GHG emissions in FY 2013, and a 7 percent decrease compared to FY 2006 base year GHG emissions.

Figure 31 presents additional details on the FY 2014 City government GHG inventory's Vehicle Fleet GHG emissions by fuel type. The largest contributors to the total Vehicle Fleet GHG emissions were diesel-trucks with approximately 52 percent of the Vehicle Fleet total, followed by gasoline with approximately 31 percent, and diesel-marine vessels with approximately 16 percent.

Figure 32 below shows the changes in City government Vehicle Fleet GHG emissions over the entire FY 2006 – FY 2014 time period. As Figure 32 shows, the major change over this time period was an approximately 29,000 tCO_2e reduction in Vehicle Fleet gasoline GHG emissions, which corresponds to an approximately 23 percent reduction in City government vehicle fleet gasoline use. With an approximately 4,000 tCO_2e increase in Vehicle Fleet diesel GHG emissions (corresponding to an approximately 3 percent increase in use), the overall net effect is a 7 percent decrease in City government Vehicle Fleet GHG emissions over the FY 2006 to FY 2014 time period, which produced a net 0.7 percent reduction in total City government GHG emissions from its FY 2006 base year emissions level.

Fig. 32: FY 2006 to FY 2014 Changes to City Government Vehicle Fleet GHG Emissions

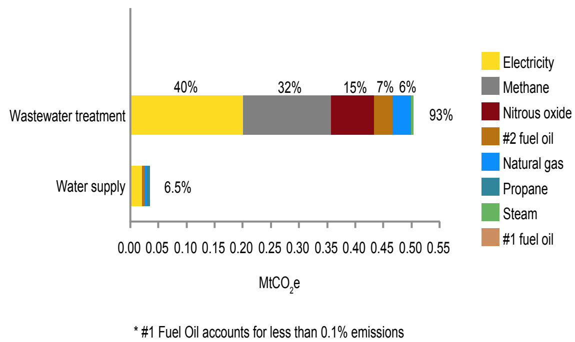


Source: NYC Mayor's Office

City Government GHG Emissions by Sector

Water Supply and Wastewater Treatment

Fig. 33: FY 2014 Water Supply and Wastewater Treatment GHG Emissions by Source

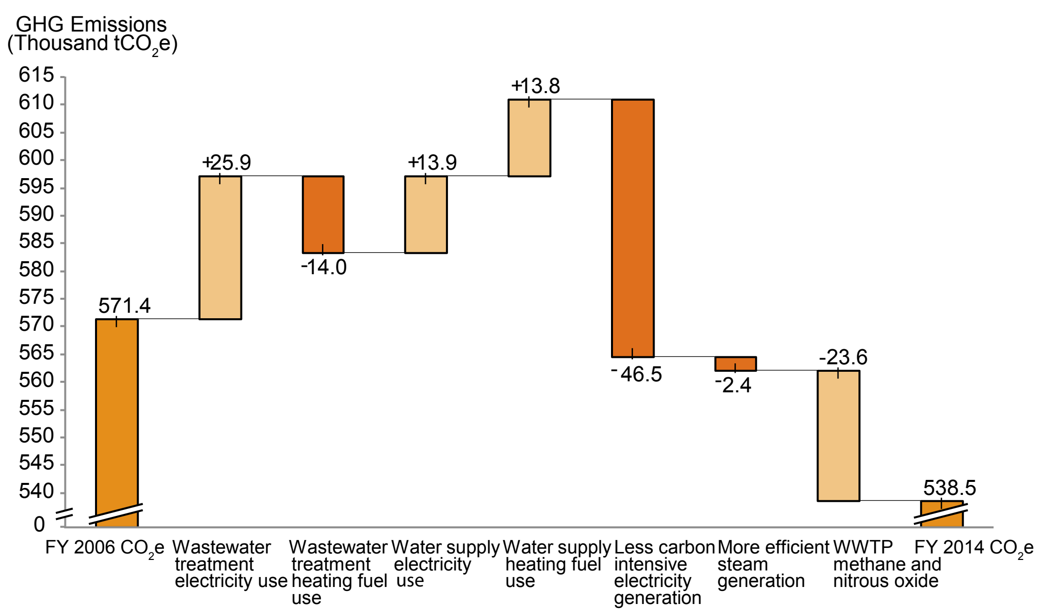


Source: NYC Mayor's Office

The New York City Department of Environmental Protection (DEP) is responsible for protecting public health and the environment by supplying clean drinking water, collecting and treating wastewater, and reducing air, noise, and hazardous substances pollution. The water is delivered from a watershed that extends more than 125 miles from the city, comprising 19 reservoirs and three controlled lakes. Approximately 7,000 miles of water mains, tunnels and aqueducts bring water to homes and businesses throughout the five boroughs, and 7,500 miles of sewer lines and 96 pump stations take wastewater to 14 in-city treatment plants. Approximately one billion gallons of water is supplied each day almost entirely by gravity to nine million residents of New York City and the surrounding counties of Orange, Ulster, Westchester, and Putnam, while approximately 1.3 billion gallons of wastewater is collected and treated each day.

While the majority of this system is designed to operate by gravity, it still requires a large amount of energy to operate—more than nine trillion source BTUs per year. As such, GHG emissions from water supply and wastewater treatment accounted for approximately 17 percent of total City government GHG emissions in FY 2014 (see Figure 33). The wastewater treatment process alone accounted for over 93 percent of the City's water supply and wastewater treatment GHG emissions. Federal and state mandates to meet new air and water quality standards, such as requiring the construction and activation of new facilities or changes to water and wastewater treatment protocols, has led to a 29 percent increase in DEP's energy use between FY 2006 and FY 2014.

Fig. 34: FY 2006 to FY 2014 Changes to City Government Water Supply and Wastewater Treatment GHG Emissions



Source: NYC Mayor's Office

Figure 34 presents the changes in City government Water Supply and Wastewater Treatment GHG emissions over the entire FY 2006 – FY 2014 time period. As Figure 34 shows, the major GHG emission reductions were due to cleaner and more efficient electricity generation, wastewater treatment plant (WWTP) methane and nitrous oxide reductions, and WWTP fuel use reductions. Increases were observed in WWTP electricity use, water supply electricity use, and water supply fuel use. The combined effect of all these changes was a net 33,000 tCO_2e GHG emissions reduction from the City government Water Supply and Wastewater Treatment sectors, or an approximately 0.9 percent reduction from the City government FY 2006 base year total GHG emissions level.

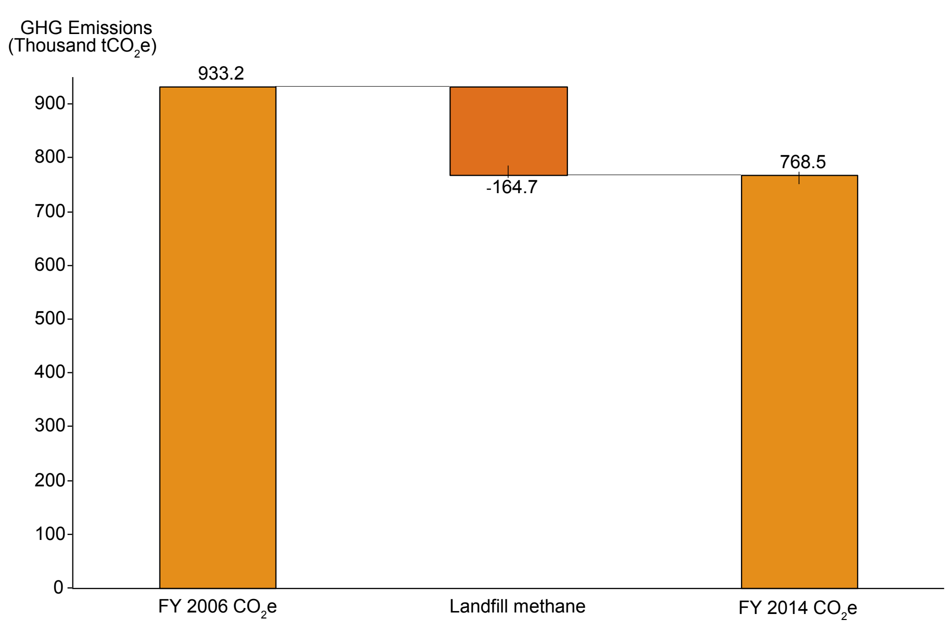
City Government GHG Emissions by Sector

Solid Waste

The New York City Department of Sanitation (DSNY) collects and manages more than 10,000 metric tons of solid waste per day, transporting it to waste to energy facilities and landfills located outside the city. The Department leads the City's efforts to contribute zero waste to landfills by 2030, a key component of OneNYC.

DSNY and DEP operate six closed landfills within New York City's boundary. As these landfills are closed and no longer accepting solid waste, GHG emissions from the decomposition of waste in these landfills is decreasing over time. Figure 35 below shows the changes in City government Solid Waste GHG emissions over the entire FY 2006– FY 2014 time period. Landfill methane GHG emissions have been reduced by approximately 165,000 tCO_2e, which corresponds to a 4.6 percent reduction from the City government FY 2006 base year total GHG emissions level.

Fig. 35: FY 2006 to FY 2014 Changes to City Government Solid Waste GHG Emissions



Source: NYC Mayor's Office

APPENDICES

Appendix A

Methodology and Restatements of Previous Years GHG Emissions

Citywide Protocol – The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)

The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) provides a robust and clear framework that builds on existing methodologies for calculating and reporting city-wide GHG emissions. The GPC sets out requirements and provides guidance for calculating and reporting city-wide GHG emissions, consistent with the 2006 IPCC (Intergovernmental Panel on Climate Change) Guidelines for National Greenhouse Gas Inventories (i.e., the "IPCC Guidelines").

The GPC requires cities to report their emissions using two distinct but complementary approaches:

- The scopes framework, which allows cities to comprehensively report all GHG emissions attributable to activities taking place within the geographic boundary of the city, by categorizing the emission sources into in-boundary sources (scope 1, or "territorial"), grid-supplied energy sources (scope 2), and out-of-boundary sources (scope 3).

- The city-induced framework measures GHG emissions attributable to activities taking place within the geographic boundary of the city. This covers selected scope 1, 2, and 3 emission sources. It provides two reporting levels demonstrating different levels of completeness. The BASIC level covers emission sources that occur in almost all cities (stationary energy, in-boundary transportation, and in-boundary generated waste), and the calculation methodologies and data are more readily available.

- New York City is utilizing the city-induced framework as the basis for its reporting.

Citywide Inventory Methodology

Stationary Energy

ConEdison (ConEd) provided data on use of citywide electricity and steam, and natural gas in the Bronx, Manhattan, and parts of Queens. National Grid reported natural gas use data for Brooklyn, parts of Queens, and Staten Island. The Long Island Power Authority (LIPA) reported electricity use data for the Rockaways area of Queens. Fuel oil use was provided by private fuel oil suppliers, per Local Law 43 of 2013, which requires fuel oil providers to report fuel oil deliveries by fuel type to the City on an annual basis. Because one fuel oil supplier failed to provide the City with data, a portion of total fuel oil sales was modeled based on a wholesale market share analysis.

Transportation

On-road transportation vehicle-miles-traveled (VMT) data was generated using the New York Best Practices (NYBPM) model. Energy use data for public transit were provided by the Metropolitan Transportation Authority (MTA) for New York City Transit (NYCT) subways and buses, Staten Island Railway (SIR), MTA Metro-North RailRoad (MNR) and Long Island Railroad (LIRR) commuter rail, and MTA Bus Company buses; by the Port Authority of New York and New Jersey (PANYNJ) for Trans-Hudson (PATH) commuter rail; and New Jersey Transit (NJT) for its commuter rail and buses. In-boundary aviation emissions were calculated from total jet fuel used by City helicopters (NYPD, DOHMH, DEP). In-boundary marine navigation GHG emissions were calculated based on total fuel sales for City government operated vessels (DOT, NYPD, FDNY, DEP).

Waste

Data used to calculate fugitive and process CH_4 and process N_2O from wastewater treatment were provided by DEP. CH_4 emissions were calculated based on the destruction of volatile material in anaerobic digesters. Based on the measured concentration and flow of volatile organic solids, it is estimated that 15 cubic feet of digester gas is produced for every pound of volatile organic solids destroyed. N_2O emissions were calculated by applying the daily nitrogen load discharged by each of the City's 14 wastewater treatment plant to the formula in the LGOP.[2] Per the GPC, biogenic CO_2 was also calculated from combustion of ADG and from fugitive ADG.

Fugitive CH_4 from in-city landfills was calculated from landfill gas collection data provided by the New York City Department of Sanitation (DSNY) and DEP per the LGOP. Fugitive CH_4 from exported solid waste sent to landfills was calculated using waste disposal figures for residential, commercial, and construction and demolition waste provided by DNSY, and applying emissions factors from the USCP, which were taken from EPA's Waste Reduction Model (WARM). CO_2, CH_4, and N_2O from solid waste sent to waste-to-energy facilities was calculated using the USCP. CH_4 and N_2O from composting was calculated using the GPC. Per the GPC, biogenic CO_2 emissions were calculated from each landfill from combustion of landfill gas from fugitive landfill gas. Fugitive CH_4 from natural gas distribution was calculated using data provided by National Grid and ConEd. GHG emissions were calculated from all data acquired as described using emission factors in Appendix H, I, and J, unless otherwise noted. Fuel economy factors for on-road vehicles were obtained from the U.S. Department of Transportation Bureau of Transportation Statistics.[5]

City Government Inventory Methodology

All data used to complete the 2014 City government GHG inventory were acquired from City agencies or fuel vendors. Electricity, natural gas, and steam usage for the City's buildings, facilities, and streetlights was provided by DCAS. Fuel vendors and DEP supplied heating and vehicle fuel usage. Calculation of GHG emissions from fuel uses the volume of fuel delivered as an estimate of the volume of fuel used.

Fugitive and process emissions were calculated using data provided by several agencies: DEP for CH_4 and N_2O emissions from wastewater treatment; DEP and DSNY for fugitive CH4 from landfills; DCAS for HFCs from municipal vehicle fleet cooling and refrigeration systems; and DSNY for emissions from the long-haul export of solid waste (Scope 3). All calculations were made as described in the citywide inventory methodology section.

Restatements of Previous Year's GHG Emissions Results

Each year, New York City reviews past years' GHG inventory results and makes adjustments where needed based on a number of factors. This year, several revisions were made that affected past citywide and City Government GHG reported emissions. Revised activity data, new vehicle miles traveled modeling, updated electricity and steam emissions factors, revised combustion fuel GHG emission factors, and updated global warming potentials all played a role in these revisions.

Citywide activity data were revised for previous years to account for underreporting of fuel oil, natural gas, and electricity data in 2013. In addition, to account for the GPC's methodology for on-road transportation modeling, revised VMT data were acquired for in-boundary on-road transportation. On-road fuel economy estimates were also updated, resulting a reduction of past years' on-road vehicle GHG emissions. Long-haul transportation of solid waste, previously included as a scope 1 GHG source in both the citywide and City government GHG inventory total, is now correctly reported as a scope 3 source, and does not count toward either inventory's total. The calculation to determine the amount of fugitive natural gas from transmission and distribution was also revised, resulting in a slight reduction of GHG emission from this source. Sulfur hexafluoride (SF_6) emissions (responsible for a significant amount of past years' citywide GHG reductions) are no longer included in the citywide total, in accordance with GPC guidance.

The GPC requires emissions from the transmission and distribution of electricity and steam to be calculated and reported a separate scope 3 sources under the GPC BASIC+ level. In the process of calculating these losses, the City discovered that it had improperly assigned such losses to the electricity and steam emission factors in past years. Transmission and distribution losses were removed for 2014 and all past years' electricity and steam emission factors, resulting in a small decrease in both factors.

The U.S. Environmental Protection Agency (EPA) has updated many of the fuel combustion emission factors used for the Greenhouse Gas Reporting Program (GHGRP) and the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013 (April 2015).[6] These updated emission factors were used all years.

The Intergovernmental Panel on Climate Change (IPCC) issued revised global warming potentials (GWPs) in the Fourth Assessment Report (2007).[7] The EPA uses these GWPs for its GHGRP and the U.S. GHG Inventory. As the GPC recommends the cities use the GWPs by its country's national GHG reporting for its GHG emissions calculation, the City has revised the GWPs for all past years accordingly, replacing the IPCC Second Assessment Report (1995) GWPs. The results of restatements to 2005 and 2013 citywide GHG emissions are shown in Tables A-7 and A-8 below.

Table A-7 Changes to 2005 citywide GHG Emissions

	$MtCO_2e$
2005 reported CO_2e	**59.11**
Revised fugitive CH_4 leakage rate	-0.111+
Revised fuel economy, VMT data	-0.514
Removal of solid waste export transportation	-0.140
Revised electricity emission factor	-1.082
Revised steam emission factor	-0.290
Revised combustion emission factors	0.186
Revised global warming potentials	0.488
Removal of SF6	-2.038
2005 restated CO2e	**55.61**

Table A-8: Changes to 2013 Reported New York City Citywide GHG Emissions

	MtCO2e
2013 reported CO2e	**48.02**
Revised electricity data	-0.002
Revised oil data	0.830
Revised natural gas data	1.055
Revised steam data	0.121
Inclusion of composting	0.003
Revised fuel economy, VMT	-1.036
Removal of solid waste export transportation	-0.091
Revised electricity emission factor	-0.562
Revised steam emission factor	-0.167
Revised combustion emission factors	0.218
Revised global warming potentials	0.392
Removal of SF6	-0.179
2013 revised CO2e	**48.60**

Appendix B

Emission Coefficients Methodologies

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

• The eGRID coefficient is regionally based on all Westchester County and New York City electricity generation,

• The eGRID coefficient does not include electricity that is imported into New York City from New Jersey or New York beyond Westchester County, which is a significant amount of the electricity supply,

• The eGRID coefficient is based on data that are several years old—the most recent eGRID coefficient is based on 2012 generation data—this does not allow the City to measure the impact of changes to the power supply that occurred during the year of analysis.

The City used power plant data from EPA's Continuous Emissions Monitoring System (CEMS) database and the U.S. Energy Information Administration's (EIA) EIA-923 database (previously titled EIA-906) to calculate the CO2e emissions coefficient from electricity. Data from these sources were acquired from ABB Enterprise Software and were organized to develop specific emissions coefficients for each plant in the New York Independent System Operator's (NYISO) and Public Service Electric and Gas (PSEG) territories. From these data, New York City's electricity emissions coefficient was calculated by taking the following steps:

1. All electricity generated within New York City (NYISO Zone J), all electricity imported to New York City through bilateral contracts between power generators and the New York Power Authority (NYPA) and Consolidated Edison of New York (ConEd), and measured electricity flows from New Jersey's PSEG territory over the Linden-VFT transmission line (PJM) were added to determine the known quantity of use from these sources.

2. Additional imported electricity volume was calculated by subtracting the combined in-city generation, bilateral contracts, and PJM imports from New York City's required energy, as listed in NYISO's 2015 Load & Capacity Data "Gold Book".

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

4. Energy use attributed to steam generation at in-city cogeneration plants was deducted from the energy input used to calculate each plant's emissions coefficient, using ConEd's steam system data, to avoid double counting emissions resulting from this generation.

5. Due to existing transmission constraints, the emissions coefficient for imported power was assumed to be generated in the downstate region (NYISO Zones G, H, and I).

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

Steam emission coefficient

The City developed its own steam emissions coefficient in cooperation with ConEd, as in past inventories. The revised steam coefficient is applied to community and City government 2014 inventories. The steam emissions coefficient is presented in detail in Appendix H.

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

Appendix C

Acronym Definitions

NYC agencies

DCAS – New York City Department of Citywide Administrative Services

DEP – New York City Department of Environmental Protection

DOHMH – New York City Department of Health and Mental Hygiene

DOT – New York City Department of Transporation

DSNY – New York City Department of Sanitation

Other entities

C40 – C40 Cities Climate Leadership Group

CARB – California Air Resources Board

CCAR – California Climate Action Registry

ConEd – Consolidated Edison of New York

EIA – United States Energy Information Administration

EPA – United States Environmental Protection Agency

ICLEI – ICLEI-Local Governments for Sustainability

LIPA – Long Island Power Authority

LIRR – Long Island Railroad

MTA – Metropolitan Transportation Authority

MNR – Metro North Rail Road

NJT – New Jersey Transit

NYCT – New York City Transit

NYISO – New York Independent System Operator

NYMTC – New York Metropolitan Transportation Council

NYPA – New York Power Authority

NYSERDA – New York State Energy Research and Development Authority

PANYNJ – Port Authority of New York and New Jersey

PATH – Port Authority Trans-Hudson Corporation

PSC – New York State Public Service Commission

PSEG – Public Service Enterprise Group

SIR – Staten Island Railway

TCR – The Climate Registry

WRI – World Resources Institute

Acronyms used throughout report

BAU – business as usual

Btu – British thermal units

CDD – cooling degree days

CEMS – Continuous Emissions Monitoring System

CH_4 – methane

CO_2 – carbon dioxide

CO_2e – carbon dioxide equivalent

CY – calendar year

eGRID – Emissions and Generation Resource Integrated Database

FY – fiscal year

GDP – gross domestic product

GHG – greenhouse gas

GJ – gigajoule

GWh – gigawatt hour

GPC – Global Protocol for Community-Scale Greenhouse Gas Emissions

HDD – heating degree days

HFCs – hydrofluorocarbons

kBtu – one thousand British thermal units

kg – kilogram

km – kilometer

LGOP – Local Government Operations Protocol

MMBtu – million British thermal units

$MtCO_2e$ – million metric tons of carbon dioxide equivalent

MW – megawatt

N_2O – nitrous oxide

PPA – power purchase agreement

ROS – rest of state

SF_6 – sulfur hexafluoride

SWMP – Solid Waste Management Plan

tCO_2e – metric ton of carbon dioxide equivalent

T&D – transmission and distribution

VFT – variable frequency transformer

VMT – vehicle miles traveled

WARM – Waste Reduction Model

Appendix D

Weather Impacts on Emissions

In PlaNYC, the City estimated that more than 40 percent of all energy used within the city's buildings was used to heat or cool building spaces. As 71 percent of the city's GHG emissions are related to buildings, heating and cooling directly affects over 30 percent of the city's carbon footprint

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

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

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

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

Fig. 36: Correlation of Cooling & Heating Degree Days to Steam Use

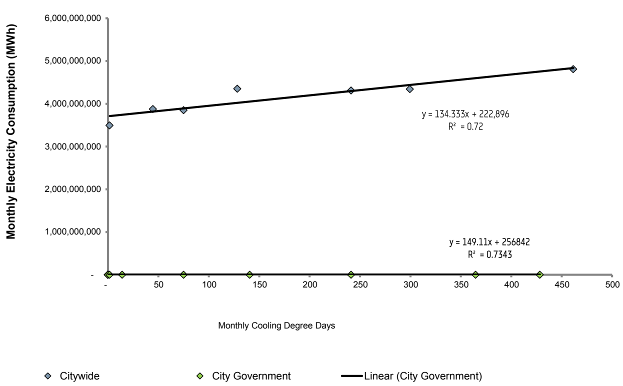


Fig. 38: Correlation of Cooling Degree Days to Electricity Use

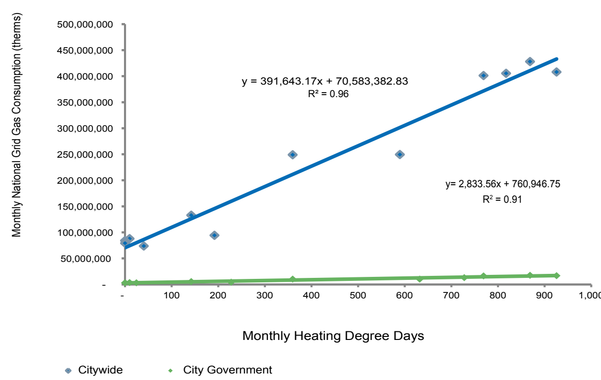


Fig. 37: Correlation of Heating Degree Days to Natural Gas Use

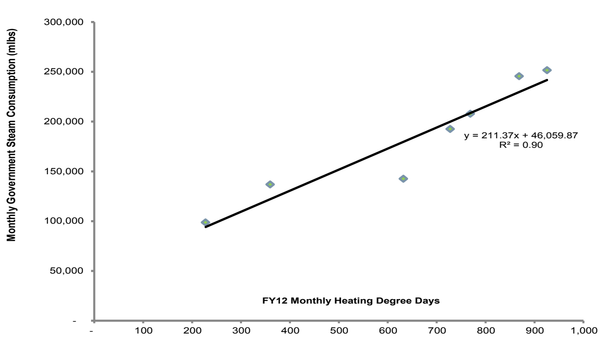
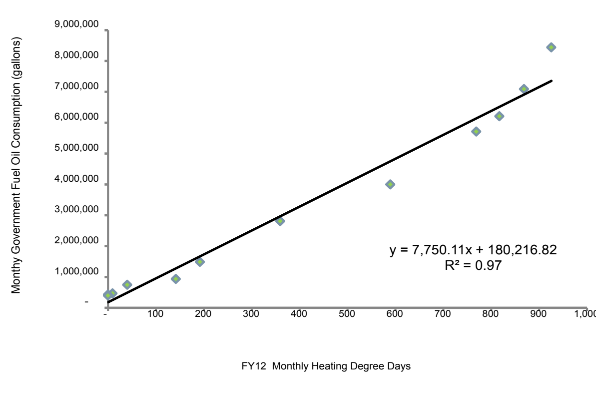


Fig. 39: Correlation of Heating Degree Days to Fuel Oil Use



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

Appendix H

Steam Emission Coefficients

	Nyc Steam Emissions Coefficients				
Year	MMBtu/metric ton of steam	Steam coefficients - kg per metric ton delivered to buildings			
		CO_2	CH_4	N_2O	CO_2e
2005	2.9325	165.7703	0.0053	0.0009	166.1850
2006	2.4357	132.8644	0.0041	0.0007	133.1826
2007	2.5226	137.8423	0.0043	0.0008	138.1739
2008	2.4630	132.0984	0.0039	0.0007	132.3949
2009	2.6250	142.5200	0.0043	0.0007	142.8481
2010	2.3331	122.4715	0.0035	0.0006	122.7282
2011	2.4499	122.6074	0.0032	0.0005	122.8326
2012	2.1083	102.7037	0.0025	0.0004	102.8749
2013	2.1638	104.8528	0.0025	0.0003	105.0162
2014	2.3022	110.6113	0.0024	0.0003	110.7578

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

Appendix I

Electricity Emission Coefficients

Year	$kgCO_2/MWh$	$kgCH_4/MW$	kgN_2o/MWh	$kgkgCO_2e/MWh$
2005	412.8353	0.0085	0.0020	413.6536
2006	366.9509	0.0066	0.0022	376.7585
2007	374.2587	0.0069	0.0069	376.5032
2008	333.5948	0.0061	0.0018	334.2930
2009	303.0547	0.0058	0.0016	303.6789
2010	303.5342	0.0056	0.0013	304.0583
2011	287.9039	0.0054	0.0010	288.3221
2012	295.0451	0.0057	0.0007	296.0431
2013	295.0451	0.0057	0.0006	295.3673
2014	292.4248	0.0056	0.0006	292.7406

Appendix J

Fuel Emission Coefficients

2014 FUEL EMISSION COEFFICIENTS						
	UNIT	GREENHOUSE GAS (kg/UNIT)				
		CO_2 (fossil)	CO_2 (biogenic)	CH_4	N_2O	CO_2e
Stationary source						
Natural gas (buildings)	GJ	50.2559		0.0050	0.000100	50.411
Natural gas (industrial)	GJ	50.2559		0.0010	0.000100	50.311
#2 fuel oil (buildings)	liter	2.7020		0.0004	0.000022	2.719
#2 fuel oil (industrial)	liter	2.7020		0.0001	0.000022	2.711
#4 fuel oil (buildings)	liter	2.8961		0.0004	0.000023	2.914
#4 fuel oil (industrial)	liter	2.8961		0.0001	0.000023	2.906
#6 residual fuel oil (buildings)	liter	2.9834		0.0004	0.000024	3.001
#6 residual fuel oil (industrial)	liter	2.9834		0.0001	0.000024	2.994
Biodiesel (biogenic carbon)	liter		2.0094	0.0000	0.000004	0.002
Propane	liter	1.4846		0.0001	0.000015	1.491
Kerosene	liter	2.6812		0.0001	0.000022	2.690
On-road **Mobile source**						
Gasoline - passenger cars	liter	2.3421		0.000168	0.000265	2.425
Gasoline - light trucks	liter	2.3421		0.0002	0.0003	2.425
Diesel passenger cars	liter	2.6799		0.000002	0.000004	2.681
Diesel - light trucks	liter	2.6799		0.000003	0.000004	2.681
Diesel - heavy duty vehicles	liter	2.6799		0.000012	0.000011	2.683
Diesel - bus	liter	2.6799		0.000017	0.000016	2.685
Biodiesel - heavy duty trucks	liter		2.0094	0.000037	0.000004	0.002
Ethanol (E100) - passenger car	liter		1.5285	0.000340	0.000414	1.660
CNG - buses	GJ	50.247		0.065902	0.005866	53.642
Off-road						
Jet Fuel	liter	2.4660			0.000079	2.490
Aviation gasoline	liter	2.1955		0.001865	0.000029	2.251
Diesel - rail locomotive	liter	2.6799		0.000211	0.000069	2.706
Diesel - marine (in port)	liter	2.6799		0.000016	0.000119	2.716

Unit Conversions

Appendix K

Citywide GHG Emissions Summary

Sector	Units	CY 2005			CY 2013			CY 2014			Change from 2013			Change from 2005		
Sector	Units	Consumed	tCO2e	Source MMBtu	Consumed	tCO2e	Source MMBtu	Consumed	tCO2e	Source MMBtu	Consumed	tCO2e	Source GJ	Consumed	tCO2e	Source GJ
Stationary Energy																
Residential (small and large residential)																
#2 fuel oil	liters	498,239,306	1,354,474	18,384,023.22	491,812,064	1,337,001	18,146,870.99	507,050,151	1,378,426	18,709,125.58	3%	3%	3%	2%	2%	2%
#4 fuel oil	liters	267,675,096	779,887	10,430,946.82	237,973,212	693,349	9,273,503.43	260,158,943	757,988	10,138,052.20	9%	9%	9%	-3%	-3%	-3%
#6 fuel oil	liters	738,901,866	2,217,745	29,648,234.55	346,561,003	1,040,171	13,905,665.10	201,715,682	605,431	8,093,786.37	-42%	-42%	-42%	-73%	-73%	-73%
Biofuel	liters	197,098	0	6,728.79	39,461,668	80	1,347,195.76	31,639,191	64	1,080,141.47	-20%	-20%	-20%	15953%	15953%	15953%
Electricity	kwh	14,168,364,734	5,860,795	142,251,024.18	15,653,318,348	4,623,479	137,096,240.02	15,164,274,320	4,439,199	132,250,770.44	-3%	-4%	-4%	7%	-24%	-7%
Natural gas	GJ	180,307,273	9,089,420	179,443,211.69	176,778,626	8,911,539	175,931,474.55	187,300,788	9,441,968	186,403,212.57	6%	6%	6%	4%	4%	4%
Steam	kg	1,998,982,584	332,201	5,861,975.08	3,035,418,339	318,768	6,567,956.12	2,914,003,579	322,749	6,708,223.33	-4%	1%	2%	46%	-3%	14%
Commercial and Institutional (commercial, institutional, and streetlights)																
#2 fuel oil	liters	282,335,121	767,534	10,417,595.24	278,693,024	757,633	10,283,209.21	287,327,924	781,107	10,601,819.59	3%	3%	3%	2%	2%	2%
#4 fuel oil	liters	47,774,309	139,193	1,861,702.07	42,473,155	123,748	1,655,123.05	46,432,836	135,285	1,809,426.61	9%	9%	9%	-3%	-3%	-3%
#6 fuel oil	liters	90,670,639	272,140	3,638,134.51	42,526,496	127,639	1,706,364.00	24,752,529	74,292	993,188.43	-42%	-42%	-42%	-73%	-73%	-73%
Biofuel	liters	49,615	0	1,693.83	9,933,615	20	339,127.16	7,964,477	16	271,902.06	-20%	-20%	-20%	15953%	15953%	15953%
Electricity	kwh	25,720,435,183	10,639,328	258,234,335.15	24,013,980,197	7,092,945	210,321,308.22	24,094,056,831	7,053,308	210,129,249.30	0%	-1%	0%	-6%	-34%	-19%
Natural gas	GJ	60,301,084	3,039,821	60,012,111.88	104,182,740	5,251,927	103,683,479.85	113,177,353	5,705,352	112,634,988.72	9%	9%	9%	88%	88%	88%
Steam	kg	7,457,786,326	1,239,372	21,869,804.15	5,691,660,761	597,717	12,315,461.65	5,463,998,032	605,180	12,578,474.29						
Manufacturing and construction (industrial)																
#2 fuel oil	liters	65,089,976	176,474	2,401,688.54	64,250,321	174,197	2,370,706.98	66,241,025	179,595	2,444,159.91	3%	3%	3%	2%	2%	2%
#4 fuel oil	liters	10,293,146	29,910	401,110.39	9,150,994	26,591	356,602.20	10,004,121	29,070	389,847.45	9%	9%	9%	-3%	-3%	-3%
#6 fuel oil	liters	7,001,414	20,959	280,929.80	3,283,815	9,830	131,762.17	1,911,343	5,722	76,692.11	-42%	-42%	-42%	-73%	-73%	-73%
Biofuel	liters	8,808	0	300.69	1,763,429	4	60,202.31	1,413,865	3	48,268.42	-20%	-20%	-20%	15953%	15953%	15953%
Electricity	kwh	8,779,889,926	3,631,833	88,150,492.85	8,914,989,284	2,633,196	78,080,026.45	8,896,415,029	2,604,342	77,587,474.14	0%	-1%	-1%	1%	-28%	-12%
Natural gas	GJ	18,090,325	910,137	18,003,633.57	24,097,257	1,212,350	23,981,779.42	26,871,577	1,351,928	26,742,803.94	12%	12%	12%	49%	49%	49%
Steam	kg	2,237,335,898	371,812	6,560,941.24	1,707,498,231	179,315	3,694,638.50	1,639,199,412	181,554	3,773,542.29	-4%	1%	2%	-27%	-51%	-42%
Electricity T&D losses	GJ	1,604,831	184,401		1,190,333	97,663		705,041	57,332							
Steam T&D losses	kg	334,042,605	55,513		292,536,309	30,721		237,330,875	26,286							
Fugitive natural gas																
CH4 - natural gas distribution	GJ	442,833	207,588		522,190	244,789		560,347	262,676		7%	7%		27%	27%	
Transportation within city (Basic)																
On-Road																
Gasoline - passenger cars	liters	2,956,960,860	7,171,573	94,897,868.24	2,875,977,547	6,975,163	92,298,867.38	2,884,413,472	6,995,622	92,569,601.89	0%	0%	0%	-2%	-2%	-2%
Diesel - passenger cars	liters	13,636,640	36,562	504,591.59	14,104,152	37,816	521,890.78	14,155,425	37,953	523,788.00	0%	0%	0%	4%	4%	4%
Gasoline - light trucks	liters	387,703,944	940,306	12,442,598.86	401,465,065	973,681	12,884,235.06	402,924,507	977,220	12,931,073.00	0%	0%	0%	4%	4%	4%
Diesel - light trucks	liters	34,436,253	92,328	1,274,232.05	41,467,149	111,179	1,534,393.72	41,617,894	111,583	1,539,971.69	0%	0%	0%	21%	21%	21%
Diesel - heavy trucks	liters	350,949,585	941,739	12,986,058.96	327,451,162	878,683	12,116,555.43	328,641,543	881,877	12,160,602.64	0%	0%	0%	-6%	-6%	-6%
Diesel - transit bus	liters	182,539,690	490,133	6,754,435.42	179,119,246	480,949	6,627,870.24	183,147,184	491,765	6,776,914.26	2%	2%	2%	0%	0%	0%
Diesel - non-transit bus	liters	68,793,026	184,715	2,545,517.92	7,164,770	19,238	265,114.81	7,325,887	19,671	271,076.57	2%	2%	2%	-89%	-89%	-89%
CNG - transit bus	GJ	249,113	13,363	247,919.07	1,441,096	77,304	1,434,190.08	1,173,494	62,949	1,167,870.59	-19%	-19%	-19%	371%	371%	371%
Biofuel	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethanol	liters	371,629,423	49,008	8,381,214.53	364,160,290	48,023	8,212,766.08	365,259,775	48,168	8,237,562.34	0%	0%	0%	-2%	-2%	-2%
Railways																
Electricity - subway and commuter ra	kwh	2,728,682,604	1,128,538	26,017,291.60	2,819,611,178	832,821	24,694,076.69	2,827,567,062	827,744	24,659,796.74	0%	-1%	0%	4%	-27%	-5%
Diesel - commuter rail	liters	5,207,217	14,089	192,680.36	5,457,605	14,766	201,945.36	5,470,547	14,801	202,424.23	0%	0%	0%	5%	5%	5%
Marine Navigation																
Diesel - marine navigation	liters	18,247,504	49,555	672,306.45	13,979,731	37,965	515,065.69	14,092,419	38,271	519,217.54				-23%	-23%	-23%
Aviation																
Jet fuel - aviation	liters	933,093	2,323	33,272.69	849,442	2,115	31,431.54	898,529	2,237	33,247.88	6%	6%	6%	-4%	-4%	0%
Waste																
Landfills																
Exported solid waste - landfill	Mg	5,963,979	2,786,944	-	4,865,719	2,250,738		4,822,473	2,228,484		-1%	-1%		-19%	-20%	
Closed landfills in city	Mg	10,059	251,475	-	4,154	103,852		3,065	76,626		-26%	-26%		-70%	-70%	
Incineration																
Exported solid waste - waste to ener	Mg	875,480	134,873		975,151	161,335		982,507	137,306							
Biological treatment																
CH4 and N2O - composting	Mg	-	-		-	2,910		-	2,910							
Wastewater treatment																
CH4 - wastewater treatment plants	Mg	6,536	163,402		6,490	162,254		5,661	141,516		-13%	-13%		-13%	-13%	
N2O - wastewater treatment plants	Mg	286	85,120		248	73,794		254	75,841		3%	3%		-11%	-11%	
TOTALS																
TOTAL Scope 1			33,187,172	475,864,741.70		32,808,313	499,817,392.34		33,710,318	517,370,766.07		2.7%	3.5%		1.6%	8.7%
TOTAL Scope 2			23,203,879	548,945,864.25		16,278,240	472,769,707.65		16,034,075	467,687,530.54		-1.5%	-1.1%		-30.9%	-14.8%
TOTAL Scope 3			28,070,981	333,532,605.93		28,404,277	366,673,402.39		27,824,337	362,390,127.33		-2.0%	-1.2%		-0.9%	8.7%
TOTAL GPC BASIC			55,616,668	1,024,810,606		48,600,872	972,587,100		49,087,800	985,058,297		1.0%	1.3%		-11.7%	-3.9%

Appendix L

City Government GHG Emissions Summary

		FY 2006			FY 2013			FY 2014			Change from 2013			Change from 2006		
Sector	Units	Consumed	MgCO2e	Source MMBtu	Consumed	MgCO2e	Source MMBtu	Consumed	MgCO2e	Source MMBtu	Consumed	MgCO2e	Source GJ	Consumed	MgCO2e	Source GJ
Buildings																
#2 fuel oil	liters	56,816,067	154,456	2,096,398.03	55,961,596	152,133	2,064,869.76	70,910,242	192,771	2,616,444.58	26.7%	26.7%	26.7%	24.8%	24.8%	24.8%
#4 fuel oil	liters	32,426,496	94,476	1,263,617.96	40,431,288	117,799	1,575,554.20	64,366,872	187,537	2,508,292.45	59.2%	59.2%	59.2%	98.5%	98.5%	98.5%
#6 fuel oil	liters	75,041,558	225,230	3,011,021.90	41,021,732	123,123	1,645,985.72	27,215,138	81,684	1,091,999.94	-33.7%	-33.7%	-33.7%	-63.7%	-63.7%	-63.7%
Biodiesel	liters	-	-	-	6,583,166	13	193,187.02	8,221,533	17	241,265.93	24.9%	24.9%	24.9%	-	-	-
Electricity	kwh	3,199,648,988	1,176,698.16	30,303,100.73	3,270,816,328	966,092.21	28,646,744.82	3,312,388,423	969,671	31,582,777.48	1.3%	0.4%	10.2%	3.5%	-17.6%	4.2%
Kerosene	liters	-	-	-	37,061	100	1,367.49	122,922	331	4,535.58	231.7%	231.7%	231.7%	-	-	-
Natural gas	GJ	11,068,300	557,961	11,015,259.13	11,235,448	566,387	11,181,606.24	11,793,163	594,502	11,736,648.53	5.0%	5.0%	5.0%	6.5%	6.5%	6.5%
Propane	liters	4,086,926	6,092	99,297.01	4,383,776	6,535	106,509.37	121,242	181	2,945.72	-97.2%	-97.2%	-97.2%	-97.0%	-97.0%	-97.0%
Steam	kg	781,066,529	104,024.43	1,902,365.83	818,773,476	85,984.50	1,771,639.61	949,238,782	105,135.59	2,185,208.62	15.9%	22.3%	23.3%	21.5%	1.1%	14.9%
Transportation																
Gasoline	liters	51,838,820	125,726	1,718,476.51	44,828,534	108,723	1,486,082.88	40,172,978	97,432	1,331,749.42	-10.4%	-10.4%	-10.4%	-22.5%	-22.5%	-22.5%
Ethanol	liters	5,972,192	788	134,688.53	4,829,184	637	108,910.71	4,463,664	589	100,667.29	-7.6%	-7.6%	-7.6%	-25.3%	-25.3%	-25.3%
Diesel - trucks	liters	60,061,625	161,169	2,222,438.33	62,990,211	169,028	2,330,803.69	61,699,127	165,564	2,283,030.20	-2.0%	-2.0%	-2.0%	2.7%	2.7%	2.7%
Biodiesel - trucks	liters	-	-	-	3,007,474	6	-	5,589,040	11	164,013.79	85.8%	85.8%	-	-	-	-
Diesel - marine vessels	liters	18,247,504	49,555	675,205.70	18,357,380	49,853	679,271.40	18,418,732	50,020	681,541.60	0.3%	0.3%	0.3%	0.9%	0.9%	0.9%
Jet fuel	liters	933,093	2,323	33,272.69	682,907	1,700	24,351.42	856,478	2,132	30,540.72	25.4%	25.4%	25.4%	-8.2%	-8.2%	-8.2%
CNG	GJ	-	-	-	948	51	943.64	-	-	-	-100.0%	-100.0%	-100.0%	-	-	-
Streetlights and Traffic Signals																
Electricity	kwh	306,246,001	112,624.57	3,180,071.29	213,322,552	63,008.51	1,868,339.69	207,758,448	60,819	1,980,923.73	-2.6%	-3.5%	6.0%	-32.2%	-46.0%	-37.7%
Wastewater Treatment																
#1 fuel oil	liters	-	-	-	-	-	-	11,364	31	420.32						
#2 fuel oil	liters	18,314,093	49,654	675,753.03	12,624,918	34,229	465,833.95	12,456,176	33,772	459,607.70	-1.3%	-1.3%	-1.3%	-32.0%	-32.0%	-32.0%
#4 fuel oil	liters	1,129,823	3,283	44,027.70	-	-	-	-	-	-	-	-	-	-100.0%	-100.0%	-100.0%
Biodiesel	liters	-	-	-	3,930	0	-	-	-	-	-100.0%	-100.0%	-	-	-	-
Gasoline	liters	-	-	-	152,386	370	5,051.67	-	-	-	-100.0%	-100.0%	-100.0%	-	-	-
Ethanol	liters	-	-	-	16,401	1	369.89	-	-	-	-100.0%	-100.0%	-100.0%	-	-	-
Electricity	kwh	596,089,952	219,217.15	5,645,423.58	654,553,637	193,333.75	5,732,767.74	684,431,069	200,361	6,525,875.41	4.6%	3.6%	13.8%	14.8%	-8.6%	15.6%
Natural gas	GJ	380,655	19,151	378,831.32	447,182	22,498	445,039.46	634,233	31,909	631,193.96	41.8%	41.8%	41.8%	66.6%	66.6%	66.6%
Steam	kg	106,123,696	14,134	258,474.90	54,437,753	5,717	117,790.90	37,389,543	4,141	86,073.13	-31.3%	-27.6%	-26.9%	-64.8%	-70.7%	-66.7%
Methane	Mg	7,068	176,698	-	7,511	187,766	-	6,267	156,679	-		-16.6%			-11.3%	
Nitrous oxide	Mg	268	79,916	-	255	75,897	-	256	76,316	-		0.6%			-4.5%	
Water Supply																
#2 fuel oil	liters	234,386	635	8,648.37	700,559	1,899	25,849.21	1,614,330	4,377	59,565.53	130.4%	130.4%	130.4%	588.7%	588.7%	588.7%
Biodiesel	liters	-	-	-	15,512	0	455.21	69,249	0	2,032.15	346.4%	346.4%	346.4%	-	-	-
Electricity	kwh	23,253,033	8,551.50	220,223.84	57,248,156	16,909.23	501,396.13	70,753,346	20,712	674,615.08	23.6%	22.5%	34.5%	204.3%	142.2%	206.3%
Kerosene	liters	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural gas	GJ	2,921	147	2,907.07	48,304	2,430	48,072.99	72,930	3,669	72,580.73	51.0%	51.0%	51.0%	2396.7%	2396.7%	2396.7%
Propane	liters	-	-	-	-	-	-	4,393,768	6,550	106,752.13	-	-	-	-	-	-
Steam	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solid Waste Facilities																
Methane	Mg	9,969	249,309		4,795	119,872		3,386	84,649			-29.4%			-66.0%	
Fugitive and Process Emissions																
HFCs - municipal vehicle fleet	Mg	-	11,370		8	12,019		8,211	11,781			-2.0%			3.6%	
TOTALS																
TOTAL Scope 1			1,967,939	23,379,843.28		1,753,069	22,390,115.94		1,782,500	24,125,828.27		1.7%	7.8%		-9.4%	3.2%
TOTAL Scope 2			1,635,250	41,509,660.18		1,331,045	38,638,678.89		1,360,840	43,035,473.45		2.2%	11.4%		-16.8%	3.7%
TOTAL Scope 1 and 2			3,603,189	64,889,503		3,084,114	61,028,795		3,143,340	67,161,302		1.9%	10.0%		-12.8%	3.5%
Scope 3																
Diesel - solid waste transport - rail	liters	3,286,649	8,892	121,614.67	5,971,487	16,157	220,960.75	5,543,611	14,999	205,128.19	-7.2%	-7.2%	-7.2%	68.7%	68.7%	68.7%
Diesel - solid waste transport - truck	liters	47,235,003	126,750	1,747,819.53	27,724,869	74,397	1,025,893.18	27,770,495	74,519	1,027,581.45	0.2%	0.2%	0.2%	-41.2%	-41.2%	-41.2%
TOTAL Scope 3 (not included in city total)			135,643			90,554			89,518			-1.1%			-34.0%	
Information item																
Biogenic CO2 from biofuels			9,129			26,717			34,712			29.9%			280.3%	

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

Appendix M

Heating and Cooling Degree Days

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

	YEAR	ANNUAL TOTAL	% CHANGE FROM PREVIOUS YEAR	% CHANGE FROM BASE YEAR
	Calendar years			
Heating degree days	2004	4,787	-	-
Heating degree days	2005	4,733	-1.1%	-
Heating degree days	2006	3,987	-15.58%	**-15.58%**
Heating degree days	2007	4,705	18.0%	**-0.6%**
Heating degree days	2008	4,598	-2.3%	**-2.9%**
Heating degree days	2009	4,760	3.5%	**0.6%**
Heating degree days	2010	4,447	-6.6%	**-6.0%**
Heating degree days	2011	4,335	-2.5%	**-8.4%**
Heating degree days	2012	3,978	-8.2%	**-16.0%**
Heating degree days	2013	4,670	17.4%	**-1.3%**
Heating degree days	2014	4,875	4.4%	**3.0%**
Cooling degree days	2004	1,053	-	-
Cooling degree days	2005	1,472	39.8%	-
Cooling degree days	2006	1,130	-23.2%	**-23.2%**
Cooling degree days	2007	1,212	7.3%	**-17.7%**
Cooling degree days	2008	1,163	-4.0%	**-21.0%**
Cooling degree days	2009	876	-24.7%	**-40.5%**
Cooling degree days	2010	1,549	76.8%	**5.2%**
Cooling degree days	2011	1,331	-14.1%	**-9.6%**
Cooling degree days	2012	1,277	-4.1%	**-13.2%**
Cooling degree days	2013	1,272	-0.4%	**-13.6%**
Cooling degree days	2014	1,128	-11.3%	**-23.4%**
	Fiscal years			
Heating degree days	2005	4,713	-	-
Heating degree days	2006	4,261	-9.6%	-
Heating degree days	2007	4,460	4.7%	**4.7%**
Heating degree days	2008	4,470	0.2%	**4.9%**
Heating degree days	2009	4,835	8.2%	**13.5%**
Heating degree days	2010	4,377	-9.5%	**2.7%**
Heating degree days	2011	4,726	8.0%	**10.9%**
Heating degree days	2012	3,715	-21.4%	**-12.8%**
Heating degree days	2013	4,637	24.8%	**8.8%**
Heating degree days	2014	4,962	7.0%	**16.5%**
Cooling degree days	2005	1,066	-	-
Cooling degree days	2006	1,435	34.6%	-
Cooling degree days	2007	1,177	-18.0%	**-18.0%**
Cooling degree days	2008	1,202	2.1%	**-16.2%**
Cooling degree days	2009	1,051	-12.6%%	**-26.8%**
Cooling degree days	2010	1,112	5.8%	**-22.5%**
Cooling degree days	2011	1,442	29.7%	**0.5%**
Cooling degree days	2012	1,317	-8.7%	**-8.2%**
Cooling degree days	2013	1,285	-2.4%	**-10.5%**
Cooling degree days	2014	1,234	-4.0%	**-14.0%**

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

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

Appendix F

Endnotes

[1]"Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: An Accounting and Reporting Standard for Cities"; World Resources Institute, C40 Cities Climate Leadership Group, and ICLEI – Local Governments for Sustainability; 2014

[2]Local Government Operations Protocol (LGOP) Version 1.1 (May 2010), pp. 14.

[3]The number of degrees that a day's average temperature is below 65 degrees Fahrenheit (18 degrees Celsius), the temperature below which buildings need to be heated.

[4]Tami Lin, DEP. For mandated projects, energy use has increased by 29 percent at these facilities.

[5]http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html

[6]http://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Main-Text.pdf

[7]https://www.ipcc.ch/report/ar4/syr/

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.