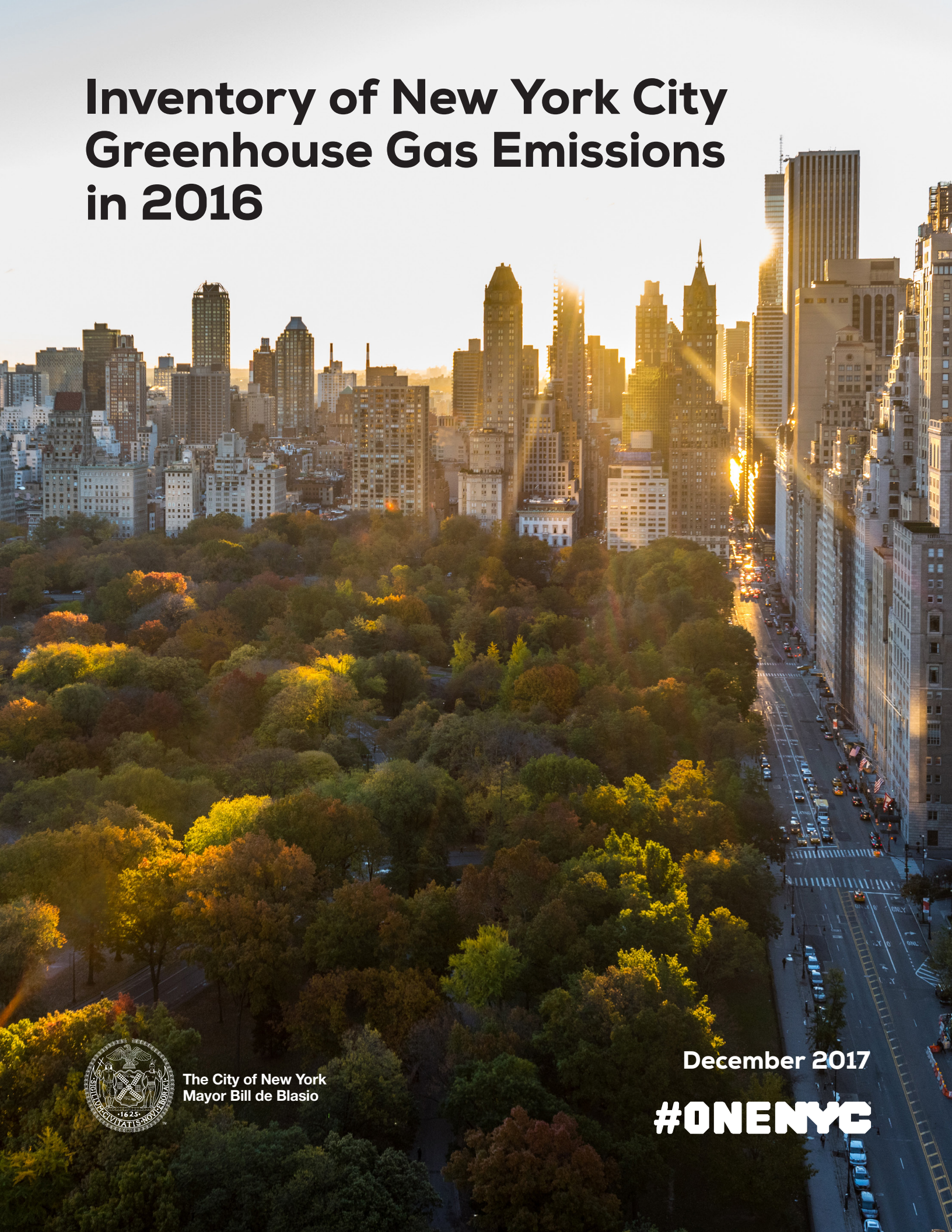
Inventory of New York City Greenhouse Gas Emissions in 2016



The City of New York
Mayor Bill de Blasio

December 2017

#ONENYC

Inventory of New York City Greenhouse Gas Emissions in 2016

The *Inventory of New York City Greenhouse Gas (GHG) Emissions* is published pursuant to Local Law 22 of 2008 and is composed of two inventories: the Citywide GHG Inventory and the City Government GHG Inventory. (November 17th 2017 updates to the 2016 GHG inventory (originaly published on October 3rd 2017.) These inventories are developed using separate GHG accounting protocols and have overlapping yet distinct scopes and boundaries.

CITYWIDE GHG INVENTORY

GHG emissions in the Citywide Inventory are calculated and reported per the guidance of the Global Protocol for Cities (GPC). This inventory consists of all direct and indirect GHG emissions from:

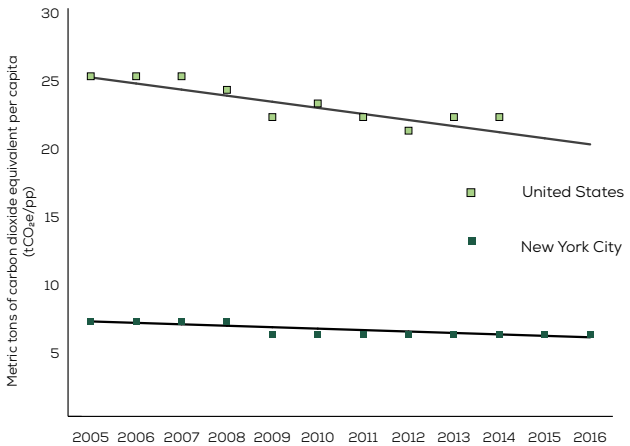
- Energy used by buildings and other stationary sources, and fugitive emissions from natural gas distribution within NYC limits;
- On-road transportation, railways, marine navigation, and aviation within city limits; and
- Wastewater treatment within city limits and solid waste generated within the city but disposed outside of city limits

These sources represent the GPC BASIC level of reporting, which is used to track the City's GHG mitigation goals. The 2016 citywide GHG emissions inventory is GPC BASIC level compliant.

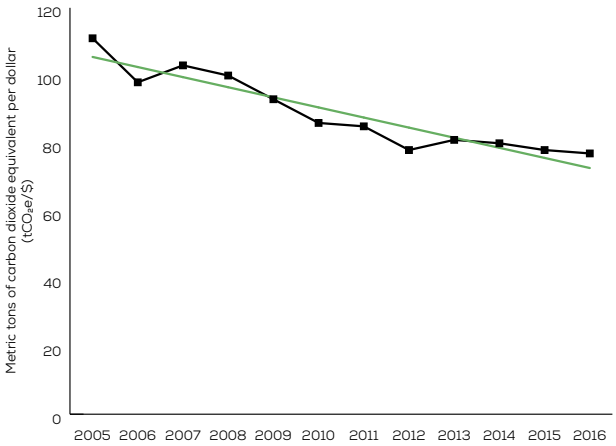
FINDINGS

Citywide GHG emissions in 2016 were 52.0 million metric tons of carbon dioxide equivalent ($MtCO_2e$). Since 2005, GHG emissions have decreased in NYC citywide by approximately 15% despite significant increases in population and economic activity, NYC's per capita GHG emissions in 2016 was on average of 6.1 metric tons of carbon dioxide equivalent (tCO_2e) emission per capita, significantly lower than the American average of 19 tCO_2e per capita. Citywide GHG emissions have remained flat since 2015.

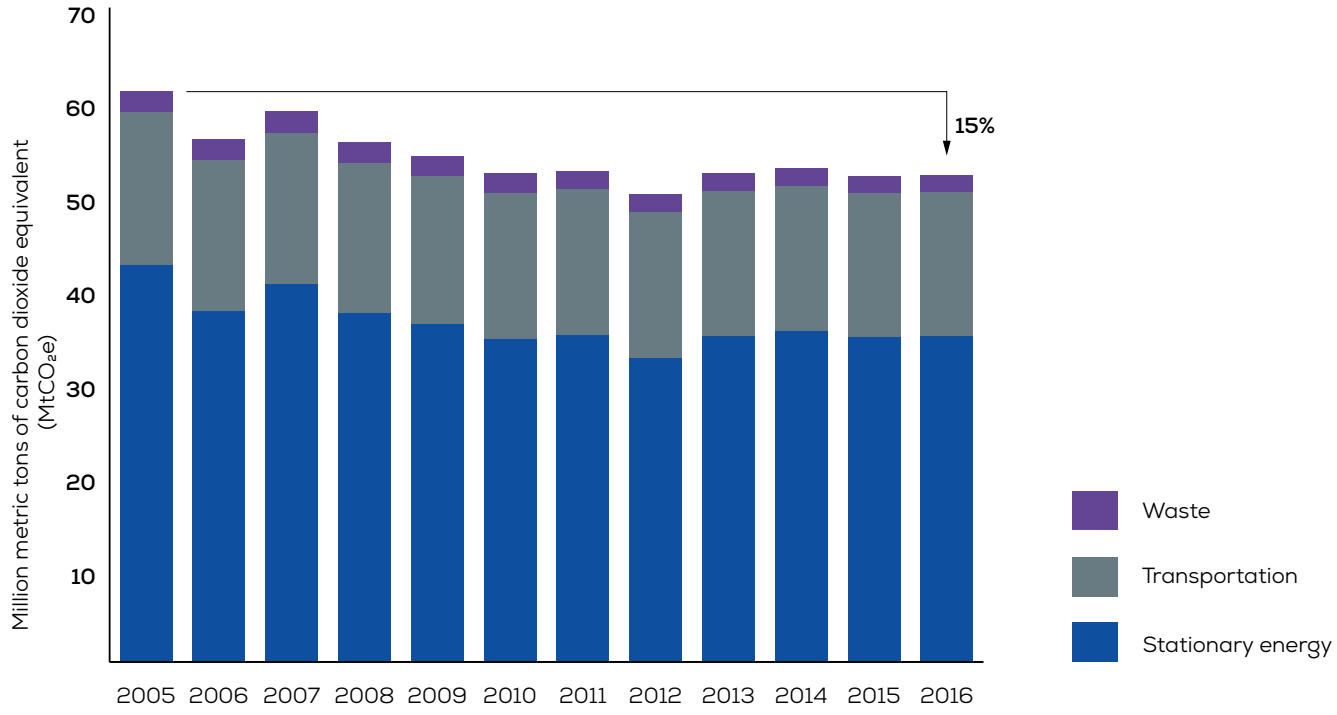
GHG EMISSIONS PER CAPITA 2005 TO 2016



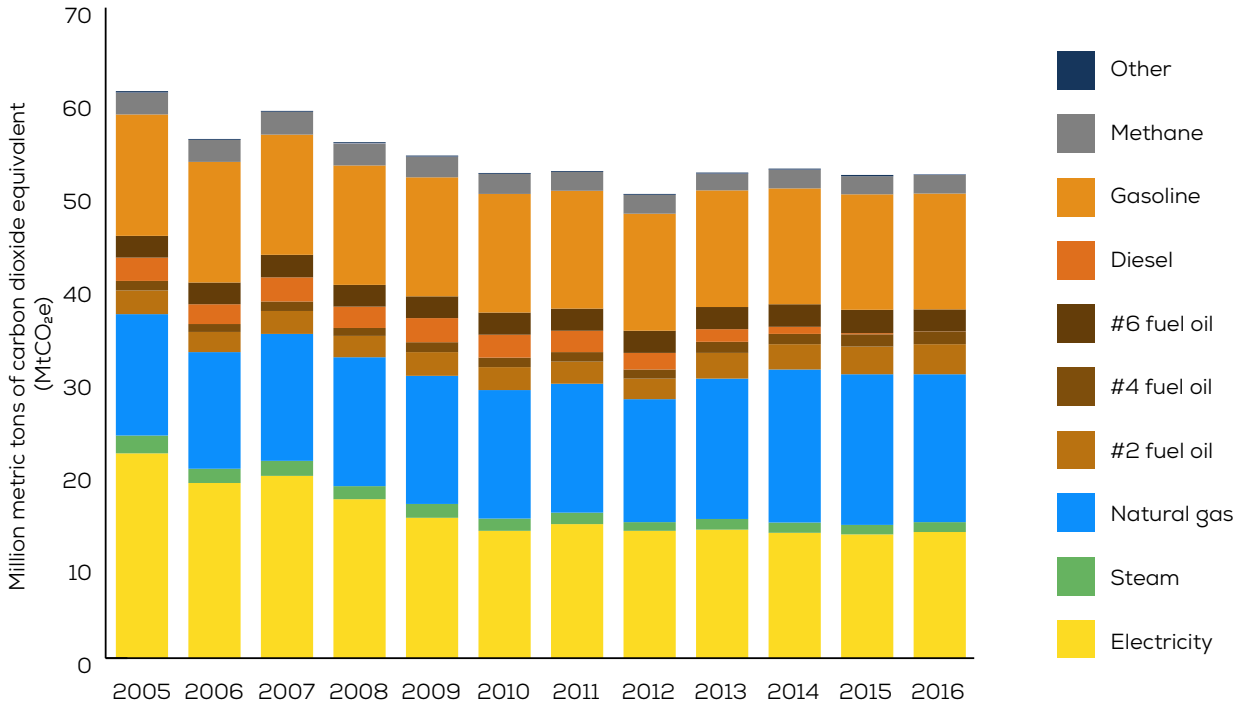
NYC GHG EMISSIONS PER GROSS CITY PRODUCT 2005 TO 2016



CITYWIDE ANNUAL GHG EMISSIONS BY SECTOR



CITYWIDE ANNUAL GHG EMISSIONS BY SOURCE



*GHG emissions from nitrous oxide and jet fuel account for less than 1% of citywide GHG emissions

CONSUMPTION-BASED EMISSIONS

Like other large cities, NYC's vibrant economy drives significant GHG emissions beyond its boundaries.

Consumption-based emissions accounting captures the direct and life cycle GHG emissions from products and services that residents consume. This includes a combination of different emission sources ranging from energy use, transportation, and waste management, to supply chain emissions of goods and services. A city's consumption-based emissions can be described using the following expression:

Consumption Emissions = Production emissions + Imported emissions – Exported emissions

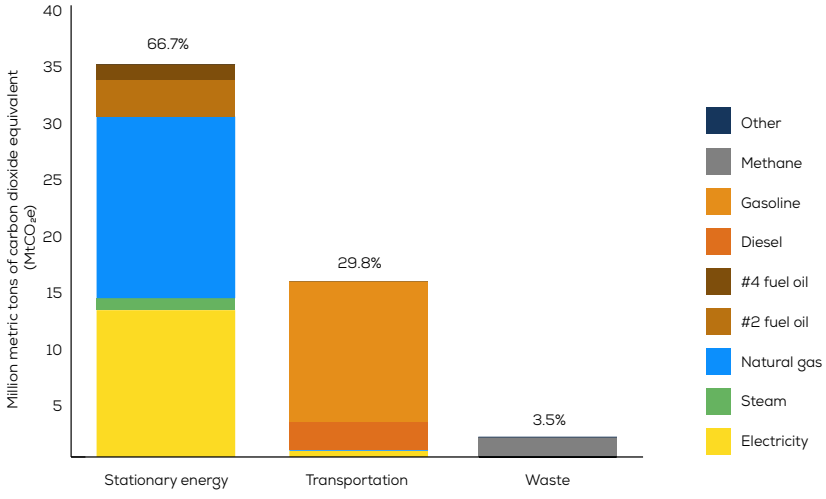
In simple terms, a city's accounting of consumption-based emissions is defined as the emissions arising within that city's boundaries, (-) minus those emissions associated with the production of goods and services exported to meet demand outside the city, (+) plus emissions arising in supply chains for goods and services produced outside the city but imported for consumption by its residents. A consumption-based GHG emissions assessment therefore cuts across Scope 1, 2 and 3 emissions categories, bringing together direct and indirect emissions sources. It reflects complex international supply chains, lifecycle emissions, and is defined by the boundary in which consumption occurs.

The City will evaluate consumption-based emissions accounting methodologies and their ability to complement the insight provided by the City's sector-based Global Protocol for Community-scale GHG emissions inventory (GPC). Using both approaches may encourage more holistic GHG emissions assessments, provide additional perspective through which to understand NYC's contribution to climate change, and identify additional opportunities for action.

EMISSIONS BY SECTOR

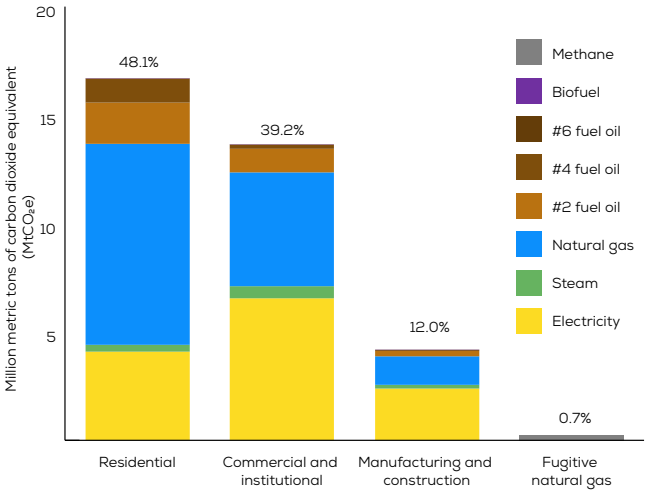
New York citywide GHG emissions come from three key sectors: stationary energy (buildings), transportation, and waste. Buildings continue to be the largest driver, accounting for 66% of total citywide GHG emissions, followed by transportation (30%), and waste (4%). The largest sources of GHG emissions in the city are combustion of natural gas (31%), use of electricity (25%) and combustion of gasoline (24%).

2016 CITYWIDE EMISSIONS BY SECTOR AND SOURCE



*GHG emissions from nitrous oxide, #6 fuel oil, and jet fuel account for less than 1% of citywide GHG emissions

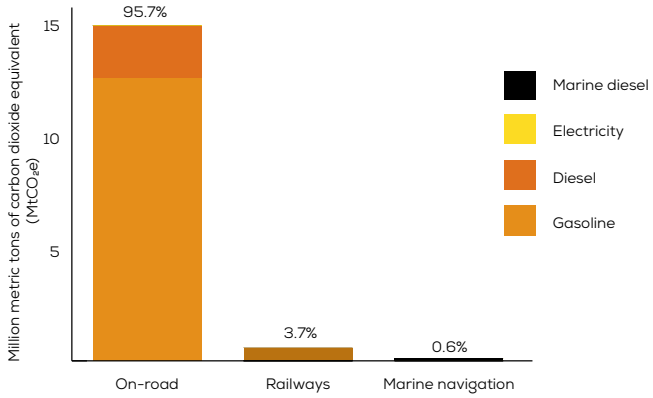
2016 CITYWIDE STATIONARY ENERGY GHG EMISSIONS BY SOURCE



STATIONARY ENERGY

Energy used in our buildings generated 34.4 $MtCO_2e$ in 2016. This sector is by far the largest source of emissions in the City. Residential buildings in NYC account for 48% of building-based emissions, while Commercial buildings in NYC account for 39%. Natural gas combustion is the main contributor from buildings, responsible for 47% of building-based emissions. Use of electricity is the second largest source of emissions, responsible for 37% of building-based emissions.

2016 CITYWIDE TRANSPORTATION GHG EMISSIONS BY SOURCE

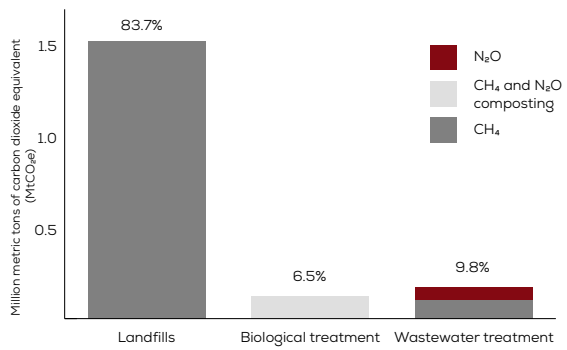


*GHG emissions from diesel hybrid, biofuel, CNG, fuel cell, ethanol, aviation gas, jet fuel, and gasoline hybrid account for less than 1% of citywide GHG emissions

TRANSPORTATION

30% of citywide emissions come from the transportation sector (15.5 $MtCO_2e$). On-road vehicles are the largest source of emissions from this sector, accounting for 96% of emissions from transportation (29% citywide). Within this sector, vehicles that consume gasoline are the primary source, accounting for 80% of transportation-based emissions.

2016 CITYWIDE WASTE GHG EMISSIONS BY SOURCE



WASTE

4% of citywide emissions come from the waste sector. Methane emissions from landfilled waste is by far the largest source from the waste sector, accounting for 85% of waste-based emissions and 3.1% of citywide emissions.

CITY GOVERNMENT GHG INVENTORY

GHG emissions in the City Government Inventory are calculated and reported per the Local Government Operations Protocol (LGOP). This 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 LGOP inventory protocol by this definition of operational control.

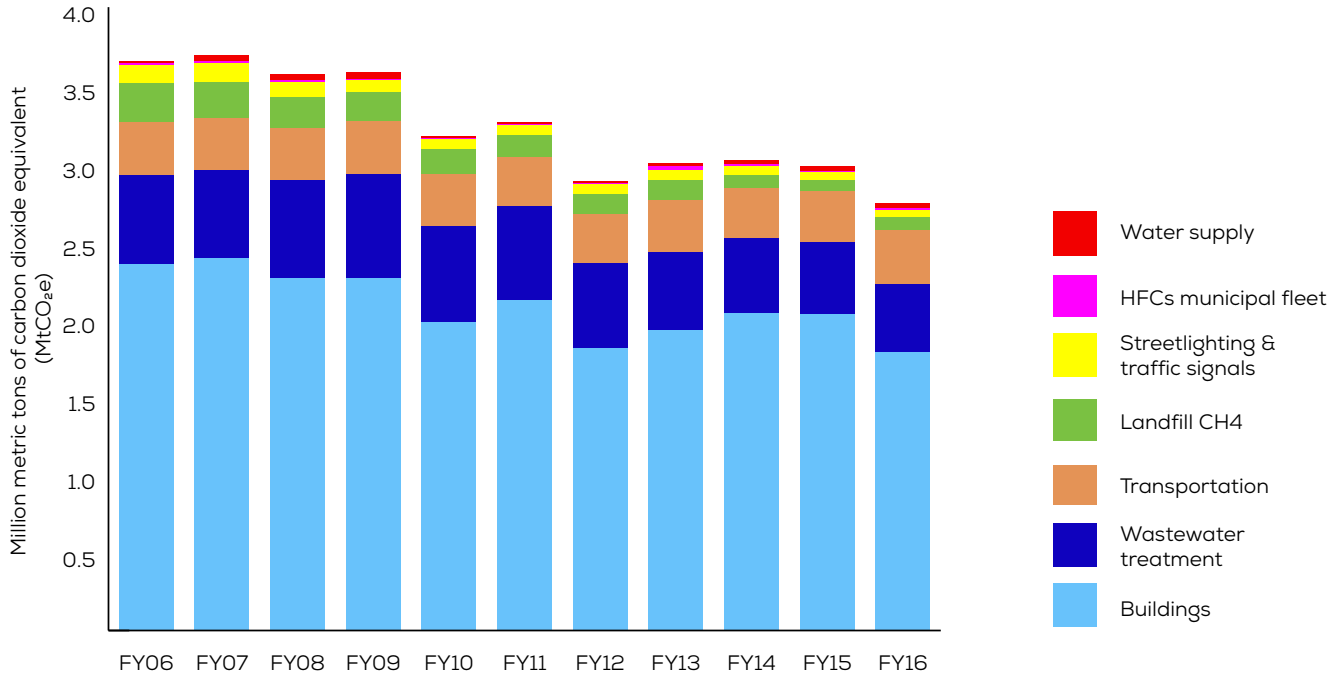
FINDINGS

City Government GHG emissions in 2016 were 2.71 MtCO2e. Since Fiscal Year (FY) 2006, GHG emissions have decreased in NYC government by approximately 25%. City Government GHG emissions have reduced over 9% from FY 2015.

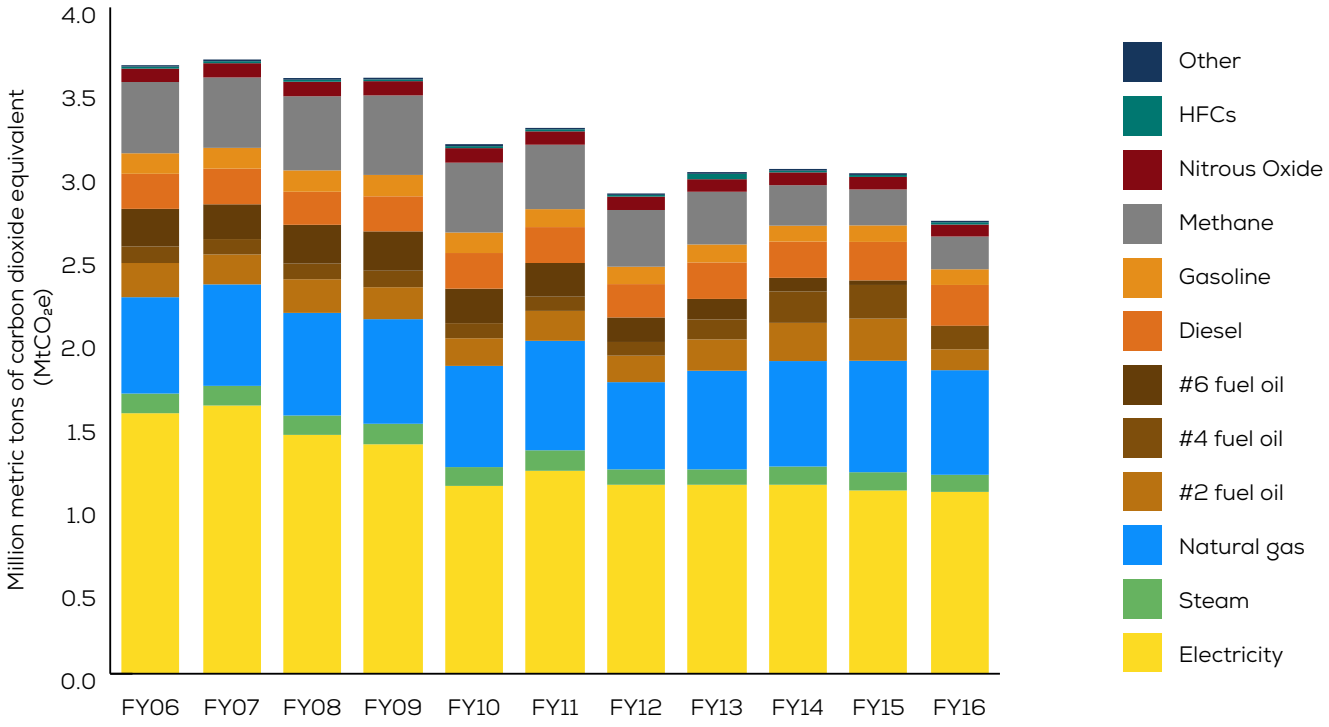
The most significant reductions in GHG emissions in 2016 come from #2, #4, and #6 fuel oils as well as from natural gas. Sizable reductions in emissions have also been observed in methane from the City's wastewater treatment facilities and in electricity consumption in its buildings.

Electricity use is the largest source of emissions, accounting for 40% of City Government emissions. Natural gas combustion is the second largest contributor to emissions the City Government portfolio accounting for 23%.

CITY GOVERNMENT ANNUAL GHG EMISSIONS BY SECTOR

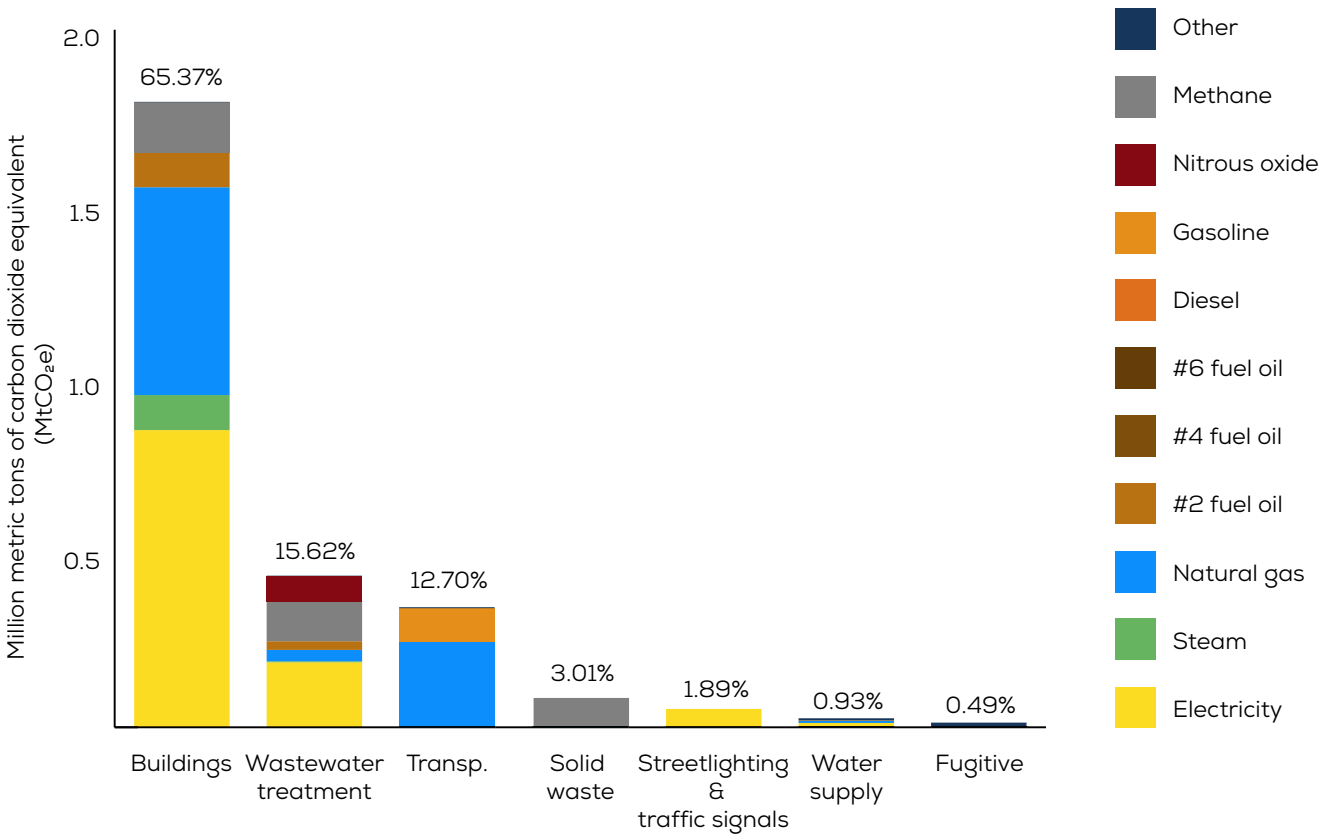


CITY GOVERNMENT ANNUAL GHG EMISSIONS BY SOURCE



*GHG emissions from HFCs, propane, aviation jet fuel, #1 fuel oil, kerosene, ethanol, and biodiesel account for less than 1% of city govenrment GHG emissions

CITY GOVERNMENT ANNUAL GHG EMISSIONS BY SECTOR AND SOURCE



*GHG emissions from HFCs, propane, jet fuel, #6 fuel oil, kerosene, ethanol, and biodiesel account for less than 1% of city govenrment GHG emissions

As is the case in the Citywide GHG Inventory, energy used in buildings is by far the largest source of emissions in City Government, generating 65% (1.8 MtCO2e) of City Government emissions.

Wastewater treatment generated 16% (0.43 MtCO2e) of City Government GHG emissions. Wastewater treatment emissions were driven by electricity consumption (43%) and methane emissions (27%).

Transportation contributed 12% (0.34 MtCO2e) of City Government GHG emissions. On-road diesel emissions were the main source of transportation-based emissions (45%), followed by Gasoline (27%), and Diesel for Marine Transport (27%).

20 YEAR GLOBAL WARMING POTENTIAL

Standard GHG accounting methods track 6 key GHGs (CO_2, CH_4, N_2O, PFCs, HFCs, SF_6). Each of these gases differs in their ability to absorb energy ("radiative efficiency"), and how long they live in the atmosphere ("lifetime"). The Global Warming Potential (GWP) of a GHG is a multiplier used to allow comparisons of the impacts of emissions of various GHGs on global warming by converting them to a common unit: tons of carbon dioxide equivalent (CO_2e). The larger the GWP the more a particular GHG warms the earth over a given timeframe. The most commonly used timeframe is 100 years. For instance, methane (CH_4) is estimated to have a GWP of 25 over 100 years.

In addition to the 100 year timeframe, New York City has also calculated GHG emissions using 20-year GWPs. These GWPs do not consider impacts that happen more than 20 years after emissions occur and therefore prioritize gases with shorter lifetimes. In the case of methane (which has a short lifetime), 100 year GWP of methane is 25, but its 20-year GWP is much higher at 84. This view of GHG emissions can provide the City with more detail when assessing short term vs long term strategies.

Key observations from this analysis include:

- Emissions from buildings remain the largest driver of Citywide emissions in both the 20 and 100 year timeframes
- The 20 year timeframe view shows that emissions from waste sectors are larger drivers of short term emissions than in the 100 year timeframe.
  - » Citywide GHG emissions from the waste sector are over twice as large as a proportion of total emissions (9% of total on 20 year timeframe, 4% on 100 year timframe).
  - » City Government GHG emissions from solid waste facilities are more than double as a proportion of total emissions. (8% of total on 20 year timeframe, 3% on 100 year timeframe).
  - » City government's wastewater treatment emissions are 25% larger (8% of total on 20 year timeframe, 3% on 100 year timeframe).
- Under a 20-year GWP framework, City government GHG emissions dropped by 29.8% relative to 2006 (compared to 24.7% under a 100-year GWP framework).

UNCERTAINTY

A GHG inventory is both an accounting and scientific exercise; uncertainty exists in data collection and aggregation, as well as in the calculation of GHG emissions. Uncertainty is inherently part of GHG calculations, as both the development of emission factors and global warming potentials involve scientific uncertainty. Uncertainty also is a part of the measurement, modeling, and estimation 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 SCOPES EMISSIONS

SECTOR	TOTAL GHG ($MtCO_2e$)			
	Scope 1	Scope 2	Scope 3	Total
STATIONARY ENERGY	21.59	12.81	-	34.40
TRANSPORTATION	14.98	0.55	-	15.53
WASTE	0.18	-	1.62	1.80
TOTAL	36.75	13.36	1.62	51.73

		CY 2005			CY 2015		
Sector	Units	Consumed	tCO_2e	Source MMbtu	Consumed	tCO_2e	Source MMbtu
STATIONARY ENERGY							
RESIDENTIAL (SMALL AND LARGE RESIDENTIAL)							
#2 fuel oil	liter	555,115,513	1,509,205	20,485,363	642,371,709	1,746,430	23,705,369
#4 fuel oil	liters	294,735,132	858,782	11,486,968	371,262,975	1,081,765	14,469,554
#6 fuel oil	liters	733,787,288	2,202,564	29,446,928	48,457,191	145,451	1,944,590
Biofuel	liters	2,723,585	5	92,994	34,527,400	59	1,178,900
Electricity	kWh	14,168,364,734	6,079,321	133,021,044	15,701,860,145	4,035,680	148,976,038
Natural gas	GJ	180,307,273	9,088,939	179,443,212	184,436,188	9,297,070	183,552,340
Steam	kg	1,998,982,584	332,201	5,749,261	2,671,762,180	286,277	6,099,429
COMMERCIAL AND INSTITUTIONAL (COMMERCIAL, INSTITUTIONAL, AND STREETLIGHTS)							
#2 fuel oil	liters	314,564,916	855,215	11,608,353	364,010,009	989,642	13,433,019
#4 fuel oil	liters	52,603,950	153,274	2,050,179	66,262,542	193,072	2,582,507
#6 fuel oil	liters	90,043,029	270,277	3,613,432	5,946,181	17,848	238,621
Biofuel	liters	685,603	1	23,409	8,691,520	15	296,762
Electricity	kWh	26,226,076,079	11,253,009	246,226,018	24,916,358,669	6,403,983	236,401,315
Natural gas	GJ	60,301,084	3,039,660	60,012,112	110,953,139	5,592,932	110,421,433
Steam	kg	7,457,786,326	1,239,372	21,449,291	5,318,470,947	569,870	12,141,662
MANUFACTURING AND CONSTRUCTION (INDUSTRIAL)							
#2 fuel oil	liters	72,520,283	196,673	2,676,208	83,919,431	227,587	3,096,869
#4 fuel oil	liters	11,333,710	32,943	441,718	14,276,502	41,496	556,410
#6 fuel oil	liters	6,952,951	20,819	279,022	459,153	1,375	18,426
Biofuel	liters	121,709	0	4,156	1,542,930	3	52,682
Electricity	kWh	8,779,889,926	3,767,250	82,430,834	9,030,045,419	2,320,895	85,675,224
Natural gas	GJ	18,090,325	910,089	18,003,634	26,789,018	1,347,703	26,660,640
Steam	kg	2,237,335,898	371,812	6,434,787	1,595,541,286	170,961	3,642,499
FUGITIVE NATURAL GAS							
CH4 - natural gas distribution	GJ	442,833	207,588	-	551,495	258,527	-
TRANSPORTATION							
ON-ROAD							
Passenger cars	VMT	19,318,051,038	12,881,945	192,791,648	20,031,919,734	12,379,304	187,598,017
Medium duty trucks	VMT	487,628,577	387,786	5,670,969	505,647,835	401,210	5,896,144
Heavy duty trucks	VMT	632,294,047	1,419,991	19,772,771	655,658,982	1,466,398	20,398,002
Buses	VMT	346,001,787	687,896	9,548,307	294,114,348	586,859	8,633,174
RAILWAYS							
Electricity - subway and commuter rail	kWh	2,223,041,708	953,856	20,871,239	2,163,557,443	556,076	20,527,391
Diesel - commuter rail	liters	5,207,218	14,098	192,691	5,452,200	14,761	201,756
MARINE NAVIGATION							
Diesel - marine navigation	liters	18,247,504	49,962	673,386	25,241,030	69,110	931,467
Biofuel	liters	-	-	-	45,333	0.1	1,548
Gasoline - marine navigation	liters	-	-	-	8,718	21	291
AVIATION							
Jet fuel - aviation	liters	933,093	2,426	33,610	1,016,754	2,643	36,623
WASTE							
LANDFILLS							
Exported solid waste - landfills	MT	7,420,036	2,021,979	-	5,538,963	1,509,381	-
BIOLOGICAL TREATMENT							
CH_4 and N_2O - composting	MT	26,351	4,991	-	564,146	106,849	-
WASTEWATER TREATMENT							
CH_4 - wastewater treatment plants	MT	6,536	163,402	-	5,841	146,037	-
N_2O - wastewater treatment plants	MT	286	85,120	-	251	74,873	-
TOTALS			61,062,452	1,084,533,543		52,042,167	1,119,368,701

CY 2016			Change from 2015			Change from 2005		
Consumed	tCO_2e	Source MMbtu	Consumed	tCO_2e	Source MMbtu	Consumed	tCO_2e	Source MMbtu
703,282,967	1,912,031	25,953,170	9%	9%	9%	27%	27%	27%
375,809,728	1,095,013	14,646,758	1%	1%	1%	28%	28%	28%
7,198,342	21,607	288,870	-85%	-85%	-85%	-99%	-99%	-99%
55,591,534	95	1,898,111	61%	61%	61%	1941%	1941%	1941%
15,448,546,032	4,022,671	147,187,634	-2%	0%	-1%	9%	-34%	11%
183,908,884	9,270,489	183,027,563	0%	0%	0%	2%	2%	2%
2,733,212,561	270,734	5,910,697	2%	-5%	-3%	37%	-19%	3%
398,526,329	1,083,482	14,706,771	9%	9%	9%	27%	27%	27%
67,074,040	195,437	2,614,135	1%	1%	1%	28%	28%	28%
883,308	2,651	35,447	-85%	-85%	-85%	-99%	-99%	-99%
13,993,956	24	477,808	61%	61%	61%	1941%	1941%	1941%
24,743,480,639	6,442,993	235,746,093	-1%	1%	0%	-6%	-43%	-4%
104,170,759	5,251,046	103,671,556	-6%	-6%	-6%	73%	73%	73%
4,861,229,054	481,522	10,512,629	-9%	-16%	-13%	-35%	-61%	-51%
91,876,877	249,168	3,390,522	9%	9%	9%	27%	27%	27%
14,451,343	42,005	563,225	1%	1%	1%	28%	28%	28%
68,207	204	2,737	-85%	-85%	-85%	-99%	-99%	-99%
2,484,226	4	84,821	61%	61%	61%	1941%	1941%	1941%
9,009,639,492	2,346,034	85,840,280	0%	1%	0%	3%	-38%	4%
26,155,341	1,315,824	26,030,000	-2%	-2%	-2%	45%	45%	45%
1,458,368,718	144,456	3,153,789	-9%	-16%	-13%	-35%	-61%	-51%
541,815	253,989	-	-2%	-2%	0%	22%	22%	0%
20,094,018,685	12,417,680	188,179,571	0%	0%	0%	4%	-4%	-2%
507,215,343	402,454	5,914,422	0%	0%	0%	4%	4%	4%
657,691,524	1,470,944	20,461,236	0%	0%	0%	4%	4%	3%
305,464,091	586,830	8,714,849	4%	0%	1%	-12%	-15%	-9%
2,128,891,161	554,345	20,283,233	-2%	0%	-1 %	-4%	-42%	-3%
5,028,922	13,615	186,093	-8%	-8%	-8%	-3%	-3%	-3%
31,937,929	87,447	1,178,602	27%	27%	27%	75%	75%	75%
52,311	0.1	1,786	15%	15%	15%	-	-	-
38,619	94	1,288	343%	343%	343%	-	-	-
974,354	2,533	35,096	-4%	-4%	-4%	4%	4%	4%
5,523,363	1,505,130	-	0%	0%	0%	-26%	-26%	0%
619,722	117,375	-	0%	0%	0%	0%	0%	0%
4,157	103,924	-	-29%	-29%	0%	-36%	-36%	0%
240	71,552	-	-4%	-4%	0%	-16%	-16%	0%
	51,735,403	1,110,698,791		0%	0%		-15%	2%

		FY 2006			FY 2015		
Sector	Units	Consumed	tCO_2e	Source Mmbtu	Consumed	tCO_2e	Source Mmbtu
BUILDINGS							
#2 fuel oil	liter	56,816,067	154,467	2,096,677	78,897,011	214,499	2,911,527
#4 fuel oil	liter	32,426,496	94,482	1,263,786	69,193,895	201,613	2,696,754
#6 fuel oil	liter	75,041,558	225,248	3,011,422	9,042,569	27,143	362,879
Biodiesel	liter	-	-	-	8,391,778	102	286,528
Electricity	kWh	3,199,648,988	1,209,240	29,041,147	3,295,468,753	846,999	31,266,734
Kerosene	liter	-	-	-	93,092	250	3,445
Natural gas	GJ	11,068,300	557,932	11,015,259	12,523,395	631,280	12,463,381
Propane	liter	4,086,926	6,095	99,310	119,359	178	2,900
Steam	kg	781,066,529	104,024	1,904,376	985,295,718	105,574	2,168,698
TRANSPORTATION							
Gasoline	liter	51,838,820	122,621	1,728,914	41,594,920	98,390	1,387,262
Ethanol	liter	5,972,192	-	134,695	4,622,552	535	104,256
Diesel - trucks	liter	60,061,625	161,136	2,222,552	60,530,889	162,396	2,239,917
Biodiesel - trucks	liter	-	-	-	6,595,968	8	225,212
Diesel - marine vessels	liter	18,247,504	49,962	673,386	25,107,072	68,744	926,523
Electricity	kWh	-	-	-	-	-	-
Jet fuel	liter	933,093	2,426	33,610	942,008	2,449	33,931
STREETLIGHTS AND TRAFFIC SIGNALS							
Electricity	kWh	306,246,001	115,739	2,779,597	201,195,422	51,711	1,908,901
WASTEWATER TREATMENT							
#1 fuel oil	liter	-	-	-	5,364	14	198
#2 fuel oil	liter	18,314,093	49,667	675,843	12,776,429	34,649	471,487
#4 fuel oil	liter	1,129,823	3,284	44,034	-	-	-
Electricity	kWh	596,089,952	225,280	5,410,323	692,309,021	177,937	6,568,486
Natural gas	liter	380,655	19,150	378,831	622,039	31,294	619,058
Steam	kg	106,123,696	14,134	258,748	37,549,979	4,023	82,650
Methane	Mg CH_4	7,068	176,698	-	5,597	139,913	-
Nitrous oxide	Mg N_2O	268	79,916	-	253	75,523	-
WATER SUPPLY							
#2 fuel oil	liter	234,386	637	8,650	1,000,355	2,720	36,916
Biodiesel	liter	-	-	-	45,854	0	1,566
Electricity	kWh	23,253,033	8,788	211,053	77,505,486	19,920	735,356
Natural gas	GJ	2,921	147	2,907	97,449	4,902	96,982
Propane	liter	-	-	-	4,919,859	7,337	119,550
SOLID WASTE FACILITIES							
Methane	Mg CH_4	9,969	249,217	-	2,975	74,386	-
FUGITIVE AND PROCESS EMISSIONS							
HFCs - municipal vehicle fleet	kg	8,722	12,513	-	8,377	12,019	-
TOTALS			3,642,804	62,995,119		2,996,507	67,721,097

FY 2016			Change from 2015			Change from 2006		
Consumed	tCO_2e	Source Mmbtu	Consumed	tCO_2e	Source Mmbtu	Consumed	tCO_2e	Source Mmbtu
36,292,258	98,669	1,339,289	-54%	-54%	-54%	-36%	-36%	-36%
48,817,617	142,242	1,902,611	-29%	-29%	-29%	51%	51%	51%
161,657	485	6,487	-98%	-98%	-98%	-100%	-100%	-100%
4,476,246	55	152,836	-47%	-47%	-47%	-	-	-
3,259,637,740	848,782	30,926,776	-1%	0%	-1%	2%	-30%	7%
-	-	-	-100%	-100%	-100%	-	-	-
11,724,754	591,022	11,668,567	-6%	-6%	-6%	6%	6%	6%
81,617	122	1,983	-32%	-32%	-32%	-98%	-98%	-98%
854,481,146	84,639	1,880,767	-13%	-20%	-13%	9%	-19%	-1%
39,396,458	93,189	1,313,940	-5%	-5%	-5%	-24%	-24%	-24%
4,379,873	507	98,783	-5%	-5%	-5%	-27%	-	-27%
56,824,209	152,451	2,102,753	-6%	-6%	-6%	-5%	-5%	-5%
6,994,728	9	238,827	6%	6%	6%	-	-	-
32,645,061	89,383	1,204,697	30%	30%	30%	79%	79%	79%
358,922	93	3,405	-	-	-	-	-	-
1,036,695	2,695	37,342	10%	10%	10%	11%	11%	11%
201,684,110	52,517	1,913,538	0%	2%	0%	-34%	-55%	-31%
780	2	29	-85%	-85%	-85%	-	-	-
8,880,845	24,085	327,729	-30%	-30%	-30%	-52%	-52%	-52%
-	-	-	-	-	-	-100%	-100%	-100%
696,495,485	181,362	6,608,207	1%	2%	1%	17%	-20%	22%
618,110	31,096	615,148	-1%	-1%	-1%	62%	62%	62%
25,301,585	2,506	55,690	-33%	-38%	-33%	-76%	-82%	-79%
4,540	113,504	-	0%	-19%	0%	0%	-36%	0%
242	72,011	-	0%	-5%	0%	0%	-10%	0%
714,742	1,943	26,376	-29%	-29%	-29%	205%	205%	205%
28,528	0	974	-38%	-38%	-38%	-	-	-
68,481,452	17,832	649,738	-12%	-11%	-12%	195%	103%	208%
118,924	5,983	118,354	22%	22%	22%	3971%	3971%	3971%
4,064,234	6,061	98,759	-17%	-17%	-17%	-	-	-
3,302	82,555	-	0%	11%	0%	0%	-67%	0%
9,157	13,393	-	0%	11%	0%	0%	7%	0%
	2,709,192	63,293,605		-10%	-7%		-26%	1%

FUEL EMISSION FACTORS

	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		0.005	0.0001	50.411
Natural Gas (industrial)	GJ	50.2559		0.001	0.0001	50.311
#2 fuel oil (buildings)	liter	2.702		0.0004	0.000022	2.719
#2 fuel oil (industrial)	liter	2.702		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 fuel oil (buildings)	liter	2.9834		0.0004	0.000024	3.001
#6 fuel oil (industrial)	liter	2.9834		0.0001	0.000024	2.994
Biodiesel (biogenic carbon)	liter		2.0094	0	0.000004	0.002
Propane	liter	1.4846		0.0001	0.000015	1.491
Kerosene	liter	2.6812		0.0001	0.000022	2.69
On-road mobile sources						
Gasoline - passenger cars	liter	2.3421		0.0002	0.000265	2.425
Gasoline - light trucks	liter	2.3421		0.0002	0.0003	2.425
Diesel passenger cars	liter	2.6799		0	0.000004	2.681
Diesel - light trucks	liter	2.6799		0	0.000004	2.681
Diesel - heavy duty vehicles	liter	2.6799		0	0.000011	2.683
Diesel - bus	liter	2.6799		0	0.000016	2.685
Biodiesel~ heavy duty trucks	liter		2.0094	0	0.000004	0.002
Ethanol (E100) - passenger cars	liter		1.5285	0.0003	0.000414	1.66
CNG - buses	GJ	50.247		0.0659	0.005866	53.642
Off-road						
Jet fuel	liter	2.466		0	0.000079	2.49
Aviation gasoline	liter	2.1955		0.0019	0.000029	2.251
Diesel - rail locomotive	liter	2.6799		0.0002	0.000069	2.706
Diesel - marine (in port)	liter	2.6799		0	0.000119	2.716

*Source: EPA Emission Factors for Greenhouse Gas Inventories, published November 19, 2015

ELECTRICITY EMISSION FACTORS

Year	$kgCO_2/MWh$	$kgCH_4/MWh$	kgN_2O/MWh	$kgCO_2e/MWh$
2005	428.1620	0.0086	0.0023	429.0771
2006	377.0922	0.0065	0.0023	377.9291
2007	378.8847	0.0068	0.0023	379.7286
2008	333.8455	0.0058	0.0019	334.5704
2009	301.1264	0.0054	0.0015	301.7056
2010	263.5869	0.0048	0.0013	264.0865
2011	279.2523	0.0052	0.0010	279.6817
2012	268.0371	0.0052	0.0008	268.3923
2013	269.2007	0.0051	0.0007	269.5332
2014	264.4634	0.0050	0.0006	264.7683
2015	256.6938	0.0051	0.0007	257.0192
2016	260.0656	0.0052	0.0007	260.3916

STEAM EMISSION FACTORS

Year	MMbtu/metric ton of steam	Steam emissions factors - kg per metric ton delivered to buildings			
		CO_2	CH_4	N_2O	CO_2e
2005	2.8761	165.7703	0.0053	0.0009	166.1850
2006	2.4382	132.8644	0.0041	0.0007	133.1826
2007	2.5226	137.8423	0.0043	0.0008	138.1739
2008	2.4609	132.0984	0.0039	0.0007	132.3949
2009	2.6251	142.5200	0.0043	0.0007	142.8481
2010	2.3331	122.4715	0.0035	0.0006	122.7282
2011	2.4225	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
2015	2.2829	107.0042	0.0023	0.0003	107.1492
2016	2.1625	98.9399	0.0020	0.0002	99.0535

HEATING AND COOLING DEGREE DAYS

	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	-1.10%	-
Heating degree days	2006	3,987	-15.80%	-15.80%
Heating degree days	2007	4,705	18.00%	-0.60%
Heating degree days	2008	4,598	-2.30%	-2.90%
Heating degree days	2009	4,760	3.50%	0.60%
Heating degree days	2010	4,447	-6.60%	-6.00%
Heating degree days	2011	4,335	-2.50%	-8.40%
Heating degree days	2012	3,978	-8.20%	-16.00%
Heating degree days	2013	4,670	17.40%	-1.30%
Heating degree days	2014	4,875	4.40%	3.00%
Heating degree days	2015	4,460	-8.50%	-5.80%
Heating degree days	2016	4,252	-4.70%	-10.20%
Cooling degree days	2004	1,053	-	-
Cooling degree days	2005	1,472	39.80%	-
Cooling degree days	2006	1,130	-23.20%	-23.20%
Cooling degree days	2007	1,212	7.30%	-17.70%
Cooling degree days	2008	1,163	-4.00%	-21.00%
Cooling degree days	2009	876	-24.70%	-40.50%
Cooling degree days	2010	1,549	76.80%	5.20%
Cooling degree days	2011	1,331	-14.10%	-9.60%
Cooling degree days	2012	1,277	-4.10%	-13.20%
Cooling degree days	2013	1,272	-0.40%	-13.60%
Cooling degree days	2014	1,128	-11.30%	-23.40%
Cooling degree days	2015	1,581	40.20%	7.40%
Cooling degree days	2016	1,489	-5.80%	1.20%
Fiscal years				
Heating degree days	2005	4,713	-	-
Heating degree days	2006	4,261	-9.60%	-
Heating degree days	2007	4,460	4.70%	4.70%
Heating degree days	2008	4,470	0.20%	4.90%
Heating degree days	2009	4,835	8.20%	13.50%
Heating degree days	2010	4,377	-9.50%	2.70%
Heating degree days	2011	4,726	8.00%	10.90%
Heating degree days	2012	3,715	-21.40%	-12.80%
Heating degree days	2013	4,637	24.80%	8.80%
Heating degree days	2014	4,962	7.00%	16.50%
Heating degree days	2015	4,974	0.20%	16.70%
Heating degree days	2016	3,768	-24.20%	-11.60%
Cooling degree days	2005	1,066	-	-
Cooling degree days	2006	1,435	34.60%	-
Cooling degree days	2007	1,177	-18.00%	-18.00%
Cooling degree days	2008	1,202	2.10%	-16.20%
Cooling degree days	2009	1,051	-12.60%	-26.80%
Cooling degree days	2010	1,112	5.80%	-22.50%
Cooling degree days	2011	1,442	29.70%	0.50%
Cooling degree days	2012	1,317	-8.70%	-8.20%
Cooling degree days	2013	1,285	-2.40%	-10.50%
Cooling degree days	2014	1,234	-4.00%	-14.00%
Cooling degree days	2015	1,229	-0.40%	-14.40%
Cooling degree days	2016	1,545	25.70%	7.70%

ERRATA

This document provides errata and clarifications regarding updates to New York City's Greenhouse Gas Inventory for Emissions in 2016, which was first released on September 15, 2017.

List of Errata and Clarifications (ordered by issuance date):

1. **Citywide & City Government: Revised electricity factor**
   The City adjusted its electricity emission factor to capture a more complete group of smaller generating facilities. The resultant emission factor is slightly lower than those reported in September 2017:

DATE ISSUED	KG CO2/MWH	KG CH4/MWH	KG N2O /MWH	KG CO2E/MWH
SEPTEMBER 2017	260.378280	0.00525483	0.000654412	260.704665
DECEMBER 2017	260.065610	0.00524907	0.000653426	260.391558

   This update had the following impacts on the Citywide and City Government inventories:
   - City Government inventory annual CO2e % change: - 0.044%
   - Citywide inventory annual CO2e % change: - 0.031%

2. **Citywide & City Government Inventory - Provided sources for emission factors**
   The December 2017 update provides sources for each emission factor used in the inventory report.

3. **Citywide Inventory - Revised electricity emission calculations to avoid double counting service classes**
   In the September 2017 inventory report, the City added the "prior period adjustments" twice in error, which increased the 2016 electricity activity data by about 743,000,000 kWh, accounting for roughly 1.5% of the electricity activity data provided by Con Edison. The City has revised electricity emission calculations to avoid double counting service classes.

4. **Citywide Inventory -Revised transportation emission factor**
   The September 2017 inventory report used an outdated emission factors for on-road transportation. The December 2017 release corrects this this error by applying the most recent emission factor available for 2015-2016 on road transportation. This update led to year-to-year increase in GHG emissions of 0.0000001%.

5. **Citywide Inventory -Removed in-city landfill calculations to avoid double counting**
   In the September 2017 inventory report, the City included the direct calculations of GHG emissions from in-city landfills used in the City Government inventory in addition to the modeled values of citywide waste emissions. This resulted in double counting emissions from in-city landfills. The City has revised emission calculations to avoid double counting emission from in-city landfills.

6. **City Government Inventory -Corrected figure "CITY GOVERNMENT ANNUAL GHG EMISSIONS BY SECTOR AND SOURCE"**
   The figure "CITY GOVERNMENT ANNUAL GHG EMISSIONS BY SECTOR AND SOURCE" incorrectly labels the value of #4 fuel oil consumption as "Methane". All methane consumed in City Government buildings is already accounted for in the natural gas category. The December 2017 update corrects this labeling error.

7. **City Government Inventory -Adjusted DEP operational boundaries to avoid double counting**
   Adjusted DEP operational boundaries to avoid double counting of emissions from fleet vehicles and heating oil.

8. **City Government Inventory -Adjusted DEP operational boundaries to include up-state operations**
   The September 2017 inventory report did not include DEP's upstate facilities in the City's utility energy calculation. This release adjusts DEP's operational boundaries to include upstate operations.

9. **City Government Inventory -Reallocated energy consumption to various uses within DEP**
   Utilizing updates classifications provided by DEP, the City has reallocated the values of energy consumed in water delivery facilities into either "building", "water supply" or "water treatment facility" categories.

10. **Citywide & City Government Inventory -Revised DCAS Marine and Prison calculations to avoid data gaps and double counting**
    The September 2017 inventory report uses a revised calculation method to account for DCAS Marine and Prison sources. Additional quality analysis was performed to increase the dataset's accuracy.

11. **Corrected Steam Emission Factor**
    Corrected Steam Emission Factor to exclude emissions from transmission and distribution losses as per Global Protocol for Community-scale Greenhouse Gas Emission Inventories Basic boundaries.

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