



Mayor's Office of Climate &
Environmental Justice



New York City Citywide CLCPA Inventory (2005 - 2021)

Executive Summary

Traditionally, New York City has reported citywide greenhouse gas (GHG) emissions using the Global Protocol for Cities (GPC) BASIC framework. This includes all emissions within the city's geographic boundaries, all combustion emissions associated with grid-supply energy sources, and all emissions associated with waste shipped out of the city.

However, the Climate Leadership and Community Protection Act (CLCPA), passed in 2019, mandates that New York State include in-state emissions as well as all emissions outside of the State associated with in-state energy use in its greenhouse gas inventory. This includes leaked emissions from the transmission and distribution of energy, in addition to emissions from the combustion of fossil fuels.

CLCPA also mandates that the State utilize a 20-year Gross Warming Potential (GWP) factor in its calculations. The 20-year GWP factor differs from the 100-year GWP factor that New York City employs in its inventory. These factors are used to compare the relative warming of greenhouse gases over a given time period to calculate carbon dioxide equivalent (CO₂e). This adjustment from the traditional 100-year GWP to the 20-year GWP results in an emphasis of the near-term warming impacts of methane.

To compare City and State emissions, the City worked with the State's Department of Environmental Conservation to develop a version of the citywide inventory using CLCPA methods. This incorporates both out-of-city fugitive emissions associated with citywide energy sources and a 20-year GWP. A comparison of the City's traditional GPC inventory and its new CLCPA inventory shows that CLCPA emissions estimates are 54% to 68% larger than GPC estimates. Furthermore, while emissions decreased across the 2005-2021 timeframe in the GPC inventory by 17.6%, that reduction was only 11.9% in the CLCPA inventory. This is largely due to the uptick in natural usage across the city and its infrastructure.

Introduction

The Inventory of New York City GHG emissions is an annual report that measures where emissions come from and tracks the City’s progress in reducing them. The report consists of two inventories: Citywide and City Government. The City Government inventory only reports emissions associated with government operations. Meanwhile, the Citywide Inventory reports all emissions taking place within the boundaries of New York City’s five boroughs, as well as waste shipped out of the city. Citywide GHG emissions have traditionally been calculated and reported in accordance with the Global Protocol for Cities (GPC) and the Global Covenant of Mayors for Climate and Energy, a global cooperative effort among mayors and city officials to reduce GHG emissions and prepare for the impacts of climate change. The citywide GHG emissions inventory is compliant with the GPC BASIC level of reporting and utilizes 100-year Gross Warming Potential factors.

By using a 100-year GWP factor, NYC’s inventory considers the relative warming of methane (CH₄), nitrous oxide (NO_x) and CO₂ over a 100-year time frame. Additionally, in compliance with GPC BASIC reporting, New York City only estimates Scope 1 and 2 and out-of-city waste emissions. This means that traditionally, emissions are only estimated for energy use within city boundaries and do not include fugitive transmission or distribution emissions associated with those energy sources (see Figure 1). New York City’s GPC BASIC inventory will from here on be referred to as the GPC inventory.

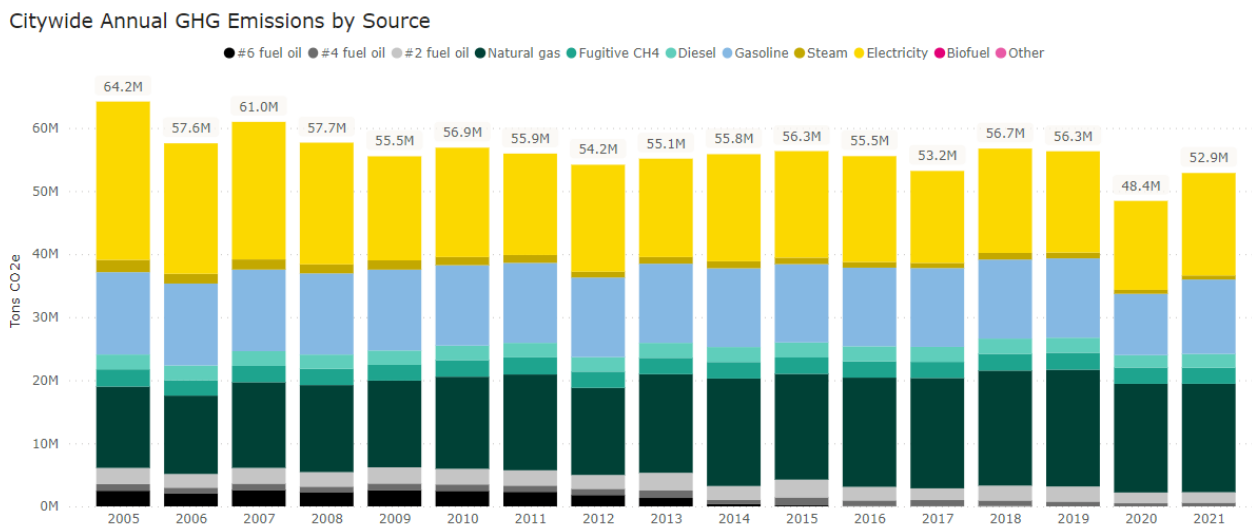


Figure 1: New York City Citywide Emissions by Source (GPC Methodology)

New York produces its annual inventory of statewide GHG emissions via the New York State Statewide Greenhouse Gas Emissions Report. The emissions inventory is designed to meet the requirements of the Climate Leadership and Community Protection Act (CLCPA). The structure and content of this report is aligned with methodology from the Intergovernmental Panel on Climate Change (IPCC) for governmental greenhouse gas accounting as used in the U.S. national greenhouse gas emissions report.

Under the CLCPA, the statewide GHG inventory must include both the annual GHG emissions produced within the state and those outside of the state associated with the generation of electricity and the fossil fuels imported into the state. Moreover, the CLCPA defines “carbon dioxide equivalent” as a measurement of GWP based on a 20-year timeframe. In order to compare New York City and New York State emissions, New York City has developed an additional inventory, referred to here as the CLCPA inventory, which incorporates both out-of-city transmission and distribution fugitive emissions associated with its energy sources and a 20-year GWP (see Figure 2).

Citywide Annual GHG Emissions by Source

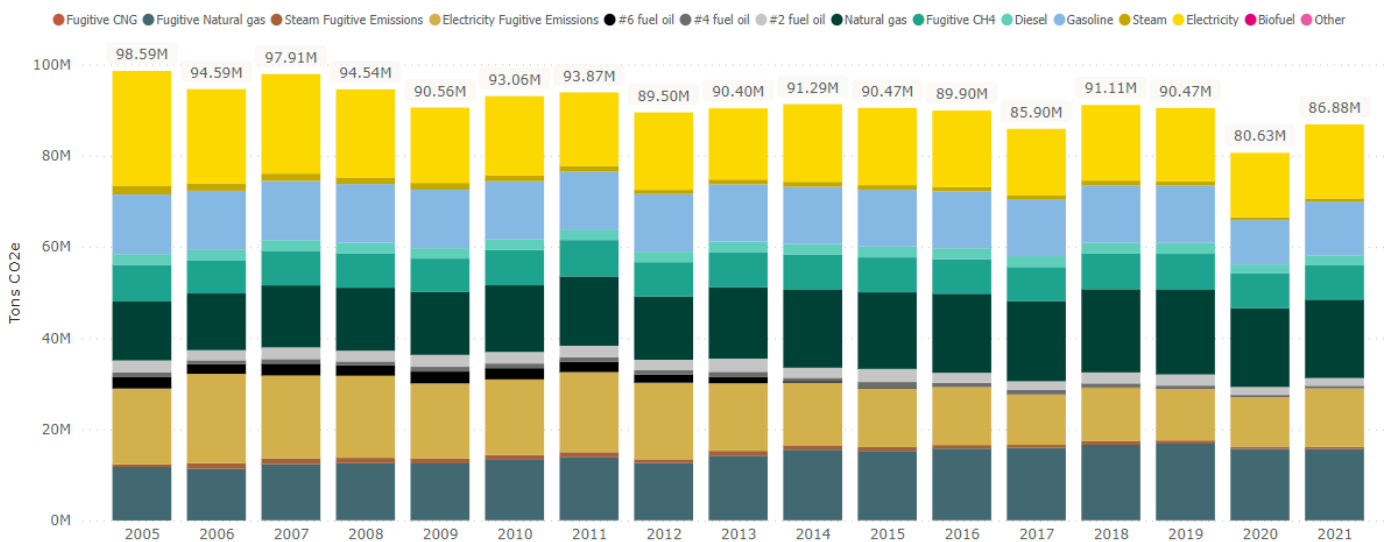


Figure 2: New York City Citywide Emissions by Source (CLCPA Methodology)

Methodology

GWP Differences

The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. It represents a measure of how much warming a given mass of greenhouse gas produces in relation to the amount of warming the same mass of carbon dioxide (CO₂) would produce over a given timeframe. The larger the GWP, the more a given gas warms the earth compared to CO₂ over that time period. Per GCP requirements, the City relies on 100-year GWP multipliers to estimate CO₂e across its inventory. To align with CLCPA methods, the inventory has been updated to estimate emissions using both 100-year GWP values and 20-year GWP values (see Table 1). In comparison to the 100-year GWP factor used in the GPC inventory, the 20-year factor in the CLCPA inventory highlights the near-term warming impacts of methane.

Greenhouse Gas	100-year GWP	20-year GWP
Carbon Dioxide	1	1
Methane	28	84
Nitrous Oxide	265	264

Table 1

Fugitive Emission Factors

The City sourced carbon dioxide, nitrous oxide, and methane emissions factors from the State’s Department of Environmental Conservation (DEC). 2019 upstream leakage emission factors were sourced from the 2021 NY State Inventory (Appendix A, Table A1) and 2020 upstream emission factors were sourced from the 2022 NY State Inventory (Appendix A, Table A1). The City utilized DEC-provided upstream emission factors for 2005-2018. Upstream emissions were estimated for all uses of electricity, steam, compressed natural gas (CNG), and natural gas in the inventory.

Table A1: 2020 Emission Rates for Upstream Out-of-State Sources (g/mmbtu)

Fuel Type	CO ₂	CH ₄	N ₂ O	Total CO ₂ e
Natural Gas	12,206	350	0.14	41,671
Diesel/ Distillate Fuel	14,599	119	0.25	24,638
Coal	3,297	401	0.10	37,029
Kerosene/Jet Fuel	9,449	106	0.16	18,413
Gasoline (E85)	4,915	33	0.08	7,671
Gasoline	18,902	125	0.32	29,504
LPG	16,582	119	0.26	26,648
Petroleum Coke	11,030	110	0.20	20,342
Residual Fuel	11,183	109	0.19	20,423

Note: Total CO₂e conversion uses GWP20 per 6 NYCRR Part 496

Downstream leakage emission factors were sourced from the 2022 NY State Inventory (Appendix A, Table A3) and estimated for all uses of CNG and Natural Gas in the inventory. CNG downstream emission factors were assumed to be the same as natural gas downstream emission factors.

Table A3: 2019 Emission Rates for Downstream In-State Sources (g/mmbtu)

Fuel Type	CO ₂	CH ₄	N ₂ O	Total CO ₂ e
Natural Gas and Renewable Natural Gas (RNG/biogas)	2.17	73	n/a	6,145

Note: Total CO₂e conversion uses GWP20 per 6 NYCRR Part 496

As 2021 upstream emission factors were not available, 2020 upstream and downstream emission factors were used in their place.

Electricity

The City sourced carbon dioxide, nitrous oxide, and methane emissions factors from the State’s Department of Environmental Conservation (DEC). 2019 upstream leakage emission factors were sourced from the 2021 NY State Inventory (Appendix A, Table A1) and 2020 upstream emission factors were sourced from the 2022 NY State Inventory (Appendix A, Table A1). The City utilized DEC-provided upstream emission factors for 2005-2018. Upstream emissions were estimated for all uses of electricity, steam, compressed natural gas (CNG), and natural gas in the inventory.

Calendar Year	kgCO2/SI unit	kgCH4/SI unit	kgN2O/SI unit
2005	0.036989	0.003410	0.000000
2006	0.042321	0.004114	0.000001
2007	0.041712	0.003642	0.000001
2008	0.041712	0.003642	0.000001
2009	0.041286	0.003376	0.000001
2010	0.044519	0.003228	0.000001
2011	0.052581	0.003377	0.000001
2012	0.057351	0.003222	0.000001
2013	0.058398	0.002775	0.000001
2014	0.061003	0.002520	0.000001
2015	0.060968	0.002257	0.000001
2016	0.061904	0.002238	0.000001
2017	0.058458	0.001886	0.000001
2018	0.063356	0.001927	0.000001
2019	0.063796	0.001873	0.000001
2020	0.072541	0.002070	0.000001
2021	0.083554	0.002390	0.000001

Table 2: 2005-2021 NYC Upstream Electricity Emissions Intensities (kg/kwh)

Steam

New York City steam has historically been fueled primarily by heavy fuel oil (#6) and natural gas, with additions from heavy fuel oil #4, #2 distillate oil, and kerosene (see Figure 3).

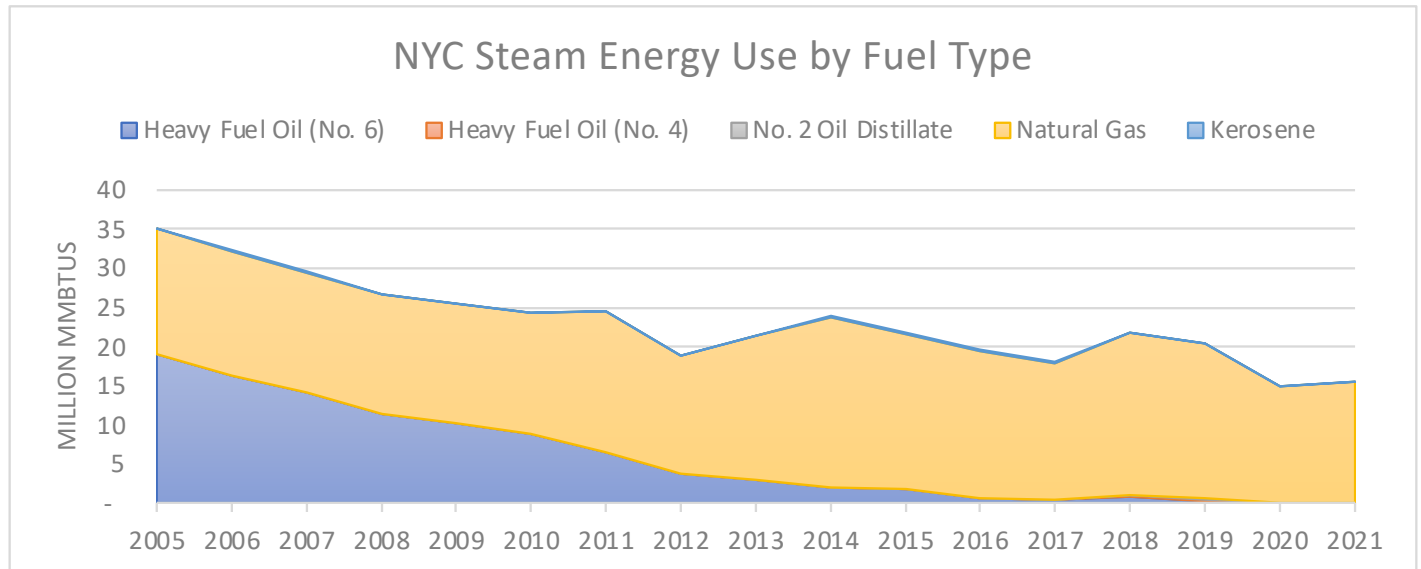


Figure 3: NYC Steam Energy Use by Fuel Type

To develop upstream steam emission factors for each year, the City took a weighted sum of the DEC-provided natural gas and kerosene upstream emissions factors. For this effort, each factor was weighted by the proportion of steam which was powered by that fuel annually. Historic steam fuel distribution data was missing for the years 2006, 2007, 2009, and 2013. In these instances, proportions were linearly interpolated from adjacent years data (see Table 3). Upstream steam emissions intensities were multiplied by the steam consumption of each year to estimate fugitive emissions associated with electricity usage.

Calendar Year	kgCO2/SI unit	kgCH4/SI unit	kgN2O/SI unit
2005	0.01394	0.00041	0.00000
2006	0.011594031	0.001152468	1.41386E-07
2007	0.012158505	0.001124026	1.46704E-07
2008	0.013148198	0.001164483	1.57882E-07
2009	0.013106221	0.001077245	1.56133E-07
2010	0.014272237	0.0010293	1.66853E-07
2011	0.017795873	0.001146281	2.04592E-07
2012	0.016588072	0.000933448	1.89944E-07
2013	0.023511301	0.000961115	2.69086E-07
2014	0.022168577	0.000906226	2.53719E-07
2015	0.021405937	0.000781771	2.45535E-07
2016	0.02162536	0.000779803	2.45715E-07
2017	0.020076634	0.000646862	2.30122E-07
2018	0.022311836	0.000679564	2.56391E-07
2019	0.022351	0.000658	2.56093E-07
2020	0.019149	0.000549	2.19639E-07
2021	0.019198	0.000550	2.20206E-07

Table 3: 2005-2021 NYC Upstream Steam Emissions Intensities (kg/kg)

Findings

A comparison of New York City’s emissions estimated under both the CLCPA and GCP methodologies is shown in Figure 4. The CLCPA inventory estimates emissions 53.6% to 67.8% larger than those in the GPC inventory over the 2005–2021 time range.

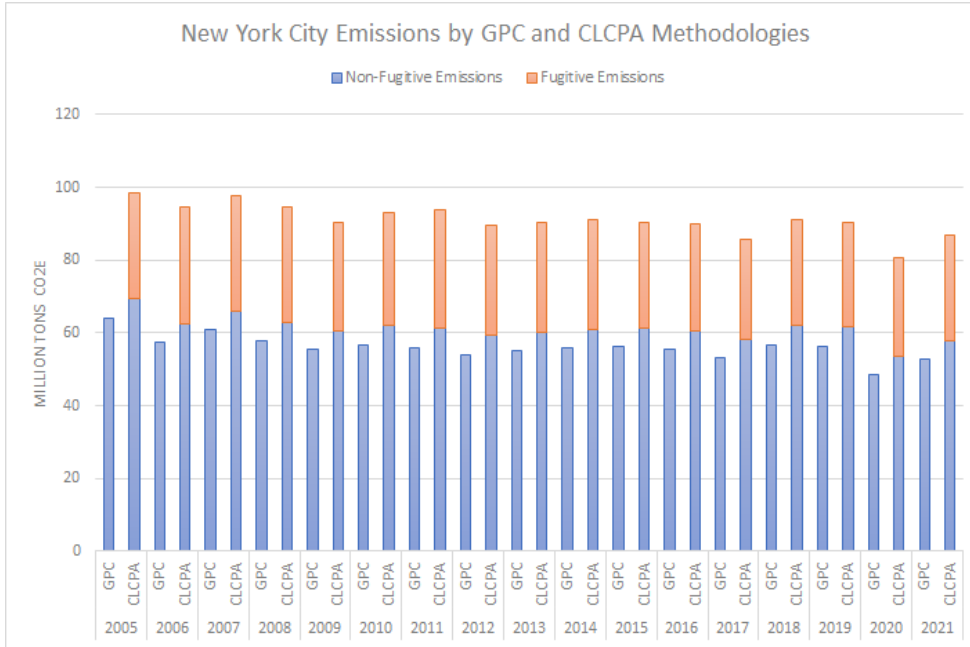


Figure 4: NYC Citywide Emissions by GPC and CLCPA Inventories

While emissions reduced by 17.6% from 2005 to 2021 under the GPC methodology, that only reduced by 11.9% under the CLCPA methodology. In 2021 the CLCPA emissions were 64.3% greater than GPC emissions and 15% of this is due to the shift GWP from the 100-year timescale to the 20-year timescale. The GCP BASIC emissions increased by 8-9% due to shift in GWP from the 100-year time scales to the 20-year time scale. The remaining 85% of this increase was due to the addition of fugitive emissions from energy sources.

