Union City

Baseline Greenhouse Gas Emissions Inventory Report

Base Year 2005

Conducted by ICLEI's Cities for Climate Protection® Campaign
In partnership with Union City

Union City Baseline Greenhouse Gas Emissions Inventory

UPDATE NOTICE

In 2008, ICLEI was hired by Stopwaste to perform revisions to the inventory largely because many pieces of the original inventories were unresolved and Stopwaste considered the inventories to be incomplete. Specifically, the waste sector methodology was under research by ICLEI and the emissions factors for electricity, natural gas, and transportation were not yet finalized. Once the emissions factors and waste methodology were finalized, ICLEI was contracted to include that data, as well as include the State Highway data. ICLEI took the opportunity to make some other minor adjustments to improve the quality of the inventories, including an updated forecast methodology and reporting emissions in the internationally accepted standard of metric tons. The revised numbers are found in Appendix D, E and F.

Table of Contents

Acknowledgements

This Greenhouse Gas Emissions Inventory Report was completed through the generous support of many individuals and organizations. The staff of Union City has been most helpful in gathering the data and doing the subsequent analysis. Particular thanks go to Roberto Munoz, Recycling Coordinator at Union City.

Many thanks are also due to StopWaste.Org. Their generous support of ICLEI and the jurisdictions in Alameda County was instrumental to this project's success.

I. Introduction

Since the early 1990's scientific consensus holds that the world's population is releasing greenhouse gases faster than the earth's natural systems can absorb them. These gases are released as by-products of fossil fuel combustion, waste disposal, energy use, land-use changes, and other human activities. This release of gases, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), creates a blanket around the earth that allows light to pass through but traps heat at the surface preventing its escape into space. Known as the greenhouse effect or global climate change, models show that this phenomenon will lead to a 2^oF to 10^oF temperature increase over the next 100 years. Already the Intergovernmental Panel on Climate Change warns that most of the warming observed over the last 50 years is attributable to human activities.

Changes in the earth's temperature will have impacts for residents of Alameda County, California. These impacts could include:

- Warmer weather associated with increased heat waves
- Wetter weather with an increase in annual rainfall of 20% to 30% leading to more serious storm events
- Rising sea levels that will threaten coastal infrastructure, ecosystems, and water supplies
- Decrease in the Sierra snow pack that will effect fresh water availability and tourism opportunities
- Increase in insect born diseases

Although one city cannot independently resolve the issue of climate change, local governments can make a positive impact through cumulative local action. Cities and counties have the ability to reduce greenhouse gas emissions through effective land use and transportation planning, wise waste management, and the efficient use of energy.

A. Baseline Emissions Inventory Report: Purpose

This report presents the results of Union City's baseline greenhouse gas emissions inventory. The inventory was conducted by ICLEI – Local Governments for Sustainability in partnership with Union City. The purpose of the baseline emissions inventory is to determine the levels of greenhouse gas emissions that Union City emits in its base year, 2005, on a municipal level and a community-wide level. This information will be used to help the city adopt an emissions reduction target and develop an emissions reduction action plan. The inventory provides important information on the jurisdictions emissions profile so that subsequent emissions reduction strategies can be tailored to the community's specific situation.

B. The Alameda County Climate Protection Project

In June 2006 Union City, along with 10 other local governments in Alameda County, committed to becoming a member of ICLEI and participating in the Alameda County Climate Protection Project. The project was launched by ICLEI in partnership with StopWaste.Org and the Alameda County Conference of Mayors. In committing to the project, Union City embarked on an ongoing, coordinated effort to reduce the emissions that cause global warming, improve air quality, reduce waste, cut energy use and save money.

C. ICLEI and the Cities for Climate Protection Campaign

ICLEI's mission is to improve the global environment through local action. The Cities for Climate Protection® (CCP) Campaign is ICLEI's flagship campaign designed to educate and empower local governments worldwide to take action on climate change. ICLEI provides resources, tools, and technical assistance to help local governments measure and reduce greenhouse gas emissions in their communities and their internal municipal operations.

ICLEI's CCP Campaign was launched in 1993 when municipal leaders, invited by ICLEI, met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce greenhouse gas emissions, improve air quality, and enhance urban sustainability. The CCP Campaign achieves these results by linking climate change mitigation with actions that improve local air quality, reduce local government operating costs, and improve quality of life by addressing other local concerns. The CCP Campaign seeks to achieve significant reductions in U.S. greenhouse gas emissions by assisting local governments in taking action to reduce emissions and realize multiple benefits for their communities.

ICLEI uses the performance-oriented framework and methodology of the CCP Campaign's Five Milestones to assist U.S. local governments in developing and implementing harmonized local approaches for reducing global warming and air pollution emissions, with the additional benefit of improving community livability. The milestone process consists of:

- Milestone 1: Conduct a baseline emissions inventory and forecast
- Milestone 2: Adopt an emissions reduction target
- Milestone 3: Develop a Climate Action Plan for reducing emissions
- Milestone 4: Implement policies and measures
- Milestone 5: Monitor and verify results

In 2006 Union City adopted a resolution to take action for climate protection and officially joined ICLEI's Cities for Climate Protection Campaign.

II. Emissions Inventory

A. Reasoning, Methodology & Model

ICLEI's Cities for Climate Protection methodology enables local governments to systematically estimate and track greenhouse gas emissions from energy use and waste related activities at the community-wide scale and those resulting directly form municipal operations. The municipal operations inventory is a subset of the community-scale inventory.

Once completed, these inventories provide the basis for creating an emissions forecast and reduction target, and enable the quantification of emissions reductions associated with implemented and proposed measures.

1. Emissions Analysis Software

To facilitate local government efforts to identify and reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) Software package with Torrie Smith Associates. This software estimates emissions derived from energy consumption and waste generation within a community. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Emissions are aggregated and reported in terms of equivalent carbon dioxide units, or eCO_2. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, so the model converts one ton of methane emissions to 21 tons of eCO_2.

The emissions coefficients and methodology employed by the software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National GHG Emissions Inventories), the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form1605), and, for emissions generated from solid waste, the U.S. EPA's Waste Reduction Model (WARM).

The CACP software has been and continues to be used by over 200 U.S. cities and counties to quantify the reduction in their greenhouse gas emissions. However, it is worth noting that, although the software provides cities/counties with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation, rather than an exact value.

2. Inventory Sources and Data Collection Process

An inventory of greenhouse gas emissions requires the collection of information from a variety of sectors and sources. For community electricity and natural gas data, ICLEI consulted Pacific Gas & Electric Company (PG&E). The Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District (BAAQMD), and Bay Area Rapid Transit (BART) served as sources of transportation data. Solid waste data was gathered from StopWaste.Org, Waste Management, Inc., Alameda County Industries, Republic Services, Inc. and the U.S. Environmental Protection Agency (U.S. EPA).

Roberto Munoz, Recycling Coordinator at Union City, coordinated the City's municipal data collection process.

These data were entered into the software to create a community emissions inventory and a municipal emissions inventory. The community inventory represents all the energy used and waste produced within Union City and its contribution to greenhouse gas emissions. The municipal inventory is a subset of the community inventory, and includes emissions derived from internal government operations.
There are two main reasons for completing separate emissions inventories for community and municipal operations. First, the government is committed to action on climate change, and has a higher degree of control to achieve reductions in its own municipal emissions than those created by the community at large. Second, by proactively reducing emissions generated by its own activities, the Union City government takes a visible leadership role in the effort to address climate change. This is important for inspiring local action in Union City as well as for inspiring other communities.

Union City's inventory is based on the year 2005. When calculating Union City's emissions inventory, all energy consumed within the city limits was included. This means that, even though the electricity used by Union City's residents is produced elsewhere, the energy and emissions associated with it appears in Union City's inventory. The decision to calculate emissions in this manner reflects the general philosophy that a community should take full ownership of the impacts associated with its energy consumption, regardless of whether the generation occurs within the geographical limits of the community.

B. Inventory Results

The results below represent Union City's completion of the first milestone of ICLEI's CCP campaign.

1. Community Emissions Inventory

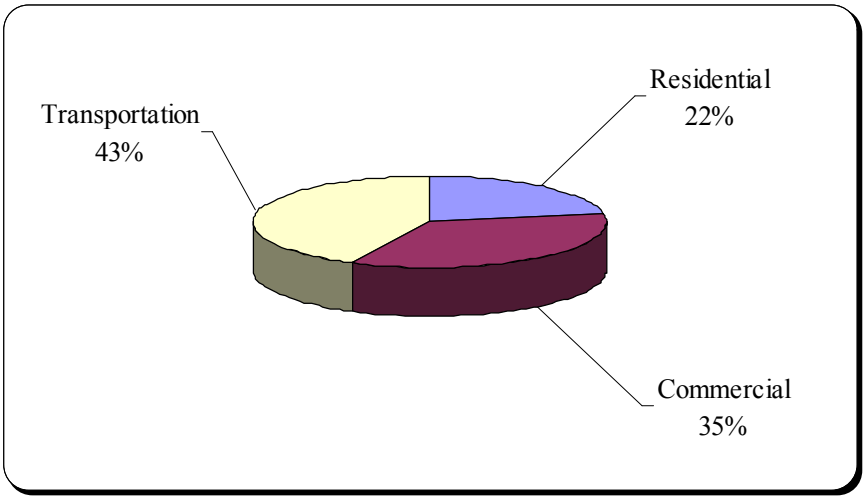
In the base year 2005, Union City emitted approximately 373,128 tons of eCO_2 from the residential, commercial/industrial, transportation and waste sectors. Burning fossil fuels in vehicles and for energy use in buildings and facilities is a major contributor to Union City's greenhouse gas emissions. Energy consumption in the transportation sector is the single biggest source of emissions, contributing 43% of total emissions. Table (1) and Figure (a) below show Union City's total greenhouse gas emissions from all major sources for the year 2005. The residential and commercial/industrial sectors represent emissions that result from electricity and natural gas used in both private and public sector buildings and facilities. The transportation sector includes emissions from private, commercial and fleet vehicles driven within the City's geographical boundaries as well as the emissions from transit vehicles and the city-owned fleet. Because approximately 75% of the methane produced from Union City's solid waste is estimated to be recovered (either captured perpetually under the liner of the landfill or captured and then flared), waste emissions appear to be slightly negative. However, the benefits gained from recycling and the associated "upstream" energy use far outweigh sending waste to the landfill (see a more in depth explanation under "Solid Waste Emissions," page 10).

Table (1): Union City Community Emissions Summary

Potential Sources	Equiv eCO2 (tons)	Energy (MMBtu)
Residential	81,632	1,224,112
Commercial/Industrial	132,271	1,902,262
Transportation	159,226	1,852,666
TOTAL	373,128	4,979,040

Source: CACP Model output

Figure (a): Union City Community Greenhouse Gas Emissions - Year 2005



Source: CACP Model output

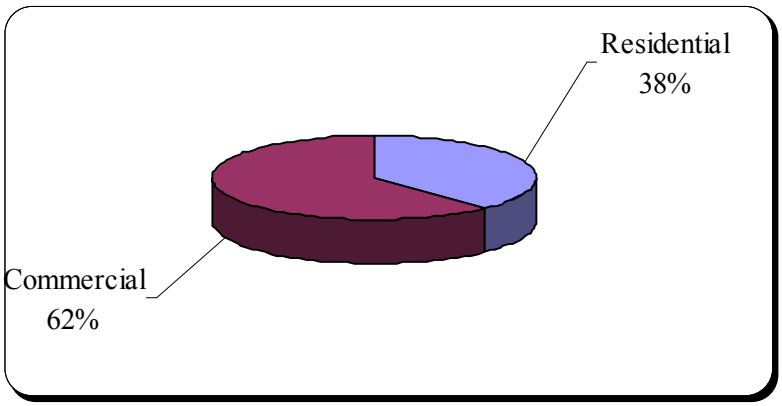
Energy / Stationary Source Emissions

In 2005, Union City's total energy consumption was about 401,794,101 kWh of electricity and 17,550,629 therms of natural gas. Stationary energy use by all sectors (residential, commercial and industrial activities) accounts for 57.3% of total greenhouse gas emissions in Union City. These emissions are a result of the combustion of fossil fuel. Union City's stationary energy use resulted in a total of approximately 213,903 tons of eCO_2 emissions in 2005.

Union City receives its electricity from Pacific Gas & Electric Company (PG&E). The 2005 emissions coefficients for electricity provided by PG&E are included in the notes in Appendix A (page 15). The types of power sources that make up a utility's electricity generation mix have a significant impact on a city's greenhouse gas emissions. A coal fired power plant, for example, releases 1.3 tons of eCO_2 per megawatt-hour of electricity generated versus 0.7 tons for gas turbines and 0 tons for renewable sources such as solar, wind, or hydroelectric power.

Figure (b) shows the breakdown of greenhouse gas emissions by sector for both electricity and natural gas combined. Of the total 213,903 tons of eCO_2 emitted due to energy use, 38% was from residential buildings and 62% was from commercial/industrial buildings.

Figure (b): Union City Community Greenhouse Gas Emissions Breakdown (Residential and Commercial/Industrial) - Year 2005



Source: CACP Model output

Residential
In 2005, Union City's 71,400 residents consumed 116,261,476 kWh of electricity, or about 5,920 kWh per household, and 8,273,148 therms of natural gas, or about 421 therms per household. This consumption resulted in a release of 81,632 tons of eCO_2. Major residential energy uses include refrigeration, lighting and water heating.

Commercial/Industrial
In 2005, Union City's commercial/industrial sector buildings consumed 285,532,625 kWh of electricity and 9,277,481 therms of natural gas. This consumption resulted in a release of 132,271 tons of eCO_2 into the atmosphere.

Transportation Emissions

The transportation sector is responsible for about 43% of Union City's greenhouse gas emissions. Motor vehicles driven within the City's geographical boundaries emitted approximately 159,226 tons of eCO_2 in 2005.

Calculations for transportation emissions are based on figures for total vehicle miles traveled (VMT) in Union City. MTC supplied the necessary VMT data, while BAAQMD provided data that enabled us to break down total VMT by percentage driven by a given vehicle type.

As a side note, ICLEI (in partnership with staff from the Bay Area Rapid Transit (BART) district) also developed a methodology for allocating the greenhouse gases that BART emits as a major regional transit provider. *The results of this quantification are meant to be illustrative and are not included in San Leandro's CO_2 baseline.* ICLEI generated the emissions estimates for BART travel by collecting 2005 electricity consumption data from BART and then allocating that consumption to Alameda County jurisdictions based on ridership (exit counts from the relevant BART stations). As BART's source of electricity through the year 2005 is hydropower, 2005 BART-related emissions are zero. That being said, BART's future fuel mix will not rely solely on hydropower. As such, based on ICLEI's methodology for allocating BART emissions to the jurisdictions that have access to a BART station, Union City is projected to be allocated 1,295 tons of eCO_2 in 2020 (based on PG&E emissions factors).

Solid Waste Emissions

In 2005, Union City sent approximately 73,039 tons of solid waste to landfills. The City also has recycling and composting measures in place, but due to lack of data availability the emissions impact of these practices is not included in this analysis.

The way in which ICLEI's CACP software calculates solid waste emissions deserves detailed explanation. The software is designed to be used in communities with a variety of waste disposal methods, including open dumping, landfilling and incineration. The emissions calculations from waste disposal are based on the U.S. EPA's Waste Reduction Model (WARM) and are consistent with national standards. The CACP software calculates waste sector emissions based on a number of factors, including: the methane recovery factor at the landfills to which the city's solid waste is sent; the total amount of solid waste sent to the landfill(s); the composition of the waste sent to the landfill(s); and emissions coefficients derived from the WARM model

A weighted average of the methane recovery factors for the landfills to which Union City sends its waste equals approximately 75% percent. This estimate is based on data supplied by the U.S. EPA's Landfill Methane Outreach Program (LMOP).

Based on emissions coefficients for the waste sector, and because more than 75 percent of the methane produced from Union city's solid waste is estimated to be recovered (either captured perpetually under the liner of the landfill or captured and then flared), waste emissions appear to be slightly negative, -16,026 tons of eCO_2 in 2005.

However, because the model does not capture the emissions credit achieved through the city's recycling efforts, we are choosing to "zero out" the emissions credit attributed to landfilling for the purposes of this inventory. Zeroing out the emissions credit for landfilling is consistent with the action taken by a number of ICLEI members, including the City and County of San Francisco.

Furthermore, the benefits gained from recycling and the associated reduction in "upstream" energy use far outweigh sending waste to the landfill. For example, if Union City recycled an additional 20,000 tons of waste, then the City would reduce its annual eCO_2 emissions by an additional amount of 53,000 tons.

Further, recent studies have begun to question the U.S. EPA's estimates for the amount of methane that is actually captured by methane recovery systems at landfills. Many hypothesize that the efficiency with which methane recovery systems capture methane is currently overestimated, and that much more of the potent greenhouse gas is actually escaping from landfills into the atmosphere. The CACP software is designed to follow EPA guidelines and the tool will be updated appropriately when those guidelines change.

Table (2) shows the approximate breakdown of the materials Union City sent to the landfill in 2005. Organic materials such as food and yard waste disposed of in landfills decompose and emit methane, a greenhouse gas 21 times more potent than CO_2. Materials that do not breakdown and release greenhouse gases are aggregated into the "All Other Waste" category.

Table (2): Union City Waste Composition

Waste Type	Waste Share
Paper Products	28.8%
Food Waste	17.0%
Plant Debris	3.0%
Wood/Textiles	13.2%
All Other Waste	38.0%
Total	**100%**

Source: StopWaste.Org

2. Municipal Operations Emissions Inventory

ICLEI's emissions analysis software and methodology enable a jurisdiction to inventory the emissions that result from municipal operations. As was noted earlier, the municipal inventory is a subset of the community inventory.

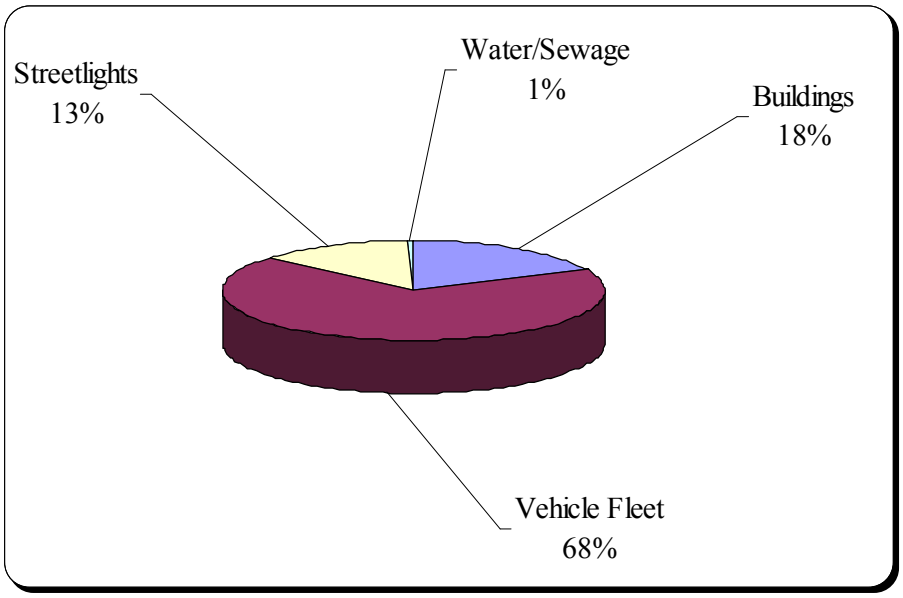
In the base year of 2005, Union City's municipal operations generated 3,886 tons of eCO_2. As Table (3) and Figure (c) show, the City's vehicle fleet accounted for the majority of emissions, followed by buildings.

Table (3): Union City Municipal Emissions Summary

Potential Sources	Equiv eCO2 (tons)	Energy (MMBtu)	Cost ($)
Buildings	716	10,006	270,623
Vehicle Fleet	2,642	30,791	405,531
Streetlights	506	6,583	213,564
Water/Sewage	21	276	12,993
TOTAL	3,886	47,656	902,710

Source: CACP Model output

Figure (c): Union City Municipal Greenhouse Gas Emissions – Year 2005



Source: CACP Model output

Municipal emissions in Union City constitute about 1.04% of Union City's total emissions. Local government emissions typically fall between 1 to 5 percent of overall community emissions. As a minor contributor to total emissions, actions to reduce municipal energy use may have a limited impact on Union City's overall community emissions levels. However, municipal action has symbolic value and demonstrates leadership that extends beyond the magnitude of emissions actually reduced.

Energy/Stationary Source Emissions

In 2005, Union City municipal buildings and facilities consumed 1,897,588 kWh of electricity and 35,299 therms of natural gas, which resulted in a release of 716 tons of eCO_2 emissions into the atmosphere. Municipal streetlights and traffic lights consumed 1,928,699 kWh of electricity, which resulted in a release of 506 tons of eCO2 emissions into the atmosphere. The Water and Sewage sector (mostly irrigation of medians) consumed 80,985 kWh of electricity which released approximately 21 tons of eCO2.

Transportation Emissions

The City's vehicle fleet consumed approximately 109,649.34 gallons of fuel and emitted about 2,642 tons of eCO_2. The municipal fleet includes all vehicles owned and operated by Union City plus some contractor vehicles performing City functions (e.g., Waste Management garbage trucks).

Solid Waste Emissions

The City sent about 822 tons of solid waste to landfills in 2005. Based on available data and the methodology employed by U.S. EPA's WARM model, municipal waste emissions appear to be slightly negative at -263 tons eCO_2. As was discussed in the section on community solid waste emissions (see page 10), this negative number will be zeroed out for the purpose of this inventory.

Table (4): Union City's Emissions Summary

Union City's Emissions Summary		
	Community Analysis	**Municipal Operations Analysis**
Base year	2005	2005
Quantity of eCO_2 emissions in base year (tons)	373,128	3,886

Source CACP Model Output

III. Forecast for Greenhouse Gas Emissions

Based on the community and municipal operations emissions inventories developed for Union City for the base year 2005, the next step was to forecast future emissions for the year 2020. The emission forecast represents a business-as-usual prediction of how greenhouse gas (GHG) emissions may change in Union City over time for the community sector.

The forecast projects the growth (or reduction) in greenhouse gas emissions that will occur in a given future year. Projections are based on the assumption that energy consumption will grow as population increases. For the community the forecast was conducted by applying population growth factors to Union City's base year residential, commercial/industrial, and transportation data. For the municipal government analysis, no growth was anticipated in the municipal government operations. Table (5) provides an emissions summary for Union City's base year and forecast year.

Table (5): Union City's Emissions Summary

Union City's Emissions Summary		
	Community Analysis	**Municipal Operations Analysis**
Base year	2005	2005
Indicators used to generate forecast	1.06% (Population growth rate based on ABAG 2000 and 2020 data)	No growth anticipated
Quantity of eCO_2 emissions in base year (tons)	373,128	3,886
Forecast year	2020	2020
Business-as-usual projection of eCO_2 emissions in *2020* (tons)	432,560	3,886

Source CACP Model Output and ABAG

Conducting an emissions forecast is essential for setting an emissions reduction target, since the amount of GHG emissions Union City pledges to reduce will be derived from projected emissions.

IV. Conclusion

This baseline greenhouse gas emissions inventory report represents a "snapshot" of the greenhouse gases that Union City emits in its base year, 2005, on a community-wide level and a municipal level. The report also approximates the greenhouse gases that the City will emit in the year 2020.

This information will be used to help the City adopt an emissions reduction target and develop a climate action plan. The climate action plan consists of policies and measures that, when implemented, will serve to get the City to its target. The inventory also serves to inform the City regarding the major sources of greenhouse gas emissions. For example, the community-wide inventory for Union City reveals that the transportation sector is responsible for 43% of total emissions.

The inventory also reveals the fact that in Union City, like in most cities, the municipal government emissions represent a small percentage of community-wide emissions, in this case only 1.04%. That being said, by proactively reducing emissions generated by its own activities, the Union City government

takes a visible leadership role in the effort to address climate change. This is important for inspiring local action in Union City as well as for inspiring action in other communities.