

Alexandra Gunner
Rosensteil School of Marine and Atmospheric Science

Abstract

Within the past century, climate scientists believe the bulk of recent warming is due to anthropogenic activities producing emissions that are altering the climate, mostly in the form of Greenhouse Gases (GHG's). In order to mitigate these impacts, nations have committed to lowering GHG emissions under an international climate pact, the Paris Agreement. Under this pact, the Global Covenant of Mayors was formed, which provides a consistent and robust platform for cities to report their greenhouse gas emissions and requires cities to complete four steps to become compliant.

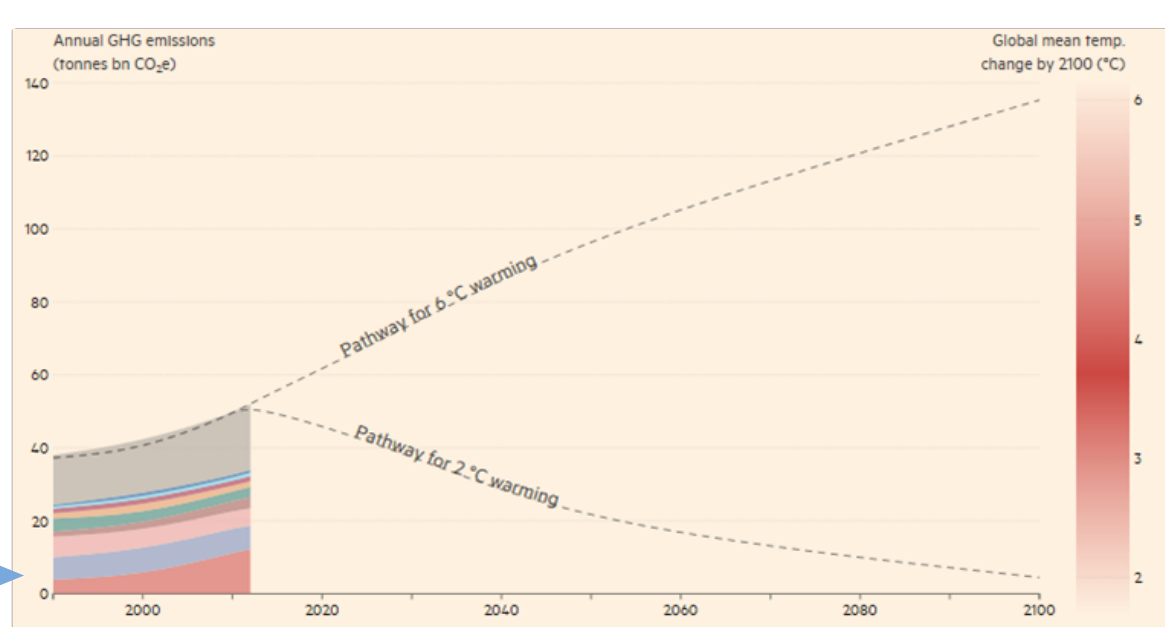
This report provides an overview and analysis of the results of the city's annual Community Wide Greenhouse Gas Emissions Inventory based on the baseline inventory of 2014, completing the second step for the city to becoming compliant.

The findings indicate that the commercial sector produced the most emissions community wide. Emissions from the energy use by the commercial sector accounted for 50% of all emissions. Additionally, it was found that the largest source of emissions came from electricity; which produced 66% of all emissions community wide. This report also finds that compared to the baseline inventory of 2014, there has been a 0.7% decrease in all emissions.

The GHG inventory serves as one of the tools within the city's toolkit to provide transparent, comprehensive adaptation planning within city boundaries, and to help develop goals and recommendations towards the city's Climate Action Plan.

Introduction

The Intergovernmental Panel on Climate Change has determined that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising in global average sea level." (IPCC)

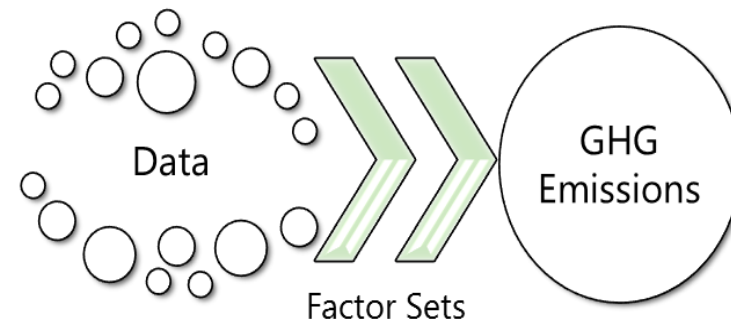


<http://fig.ft.com/sites/climate-change-calculator/>

The goal of the Paris Agreement is to reduce GHG emissions in order to follow the lowest warming trajectory. Many municipalities recognize that cities can contribute a substantial amount to emissions due to a growing population and increased development. In 2016, the Compact of Mayors and the European Covenant of Mayors joined to become the Global Covenant of Mayors for Climate and Energy, the largest global coalition dedicated to climate leadership, involving 7,100 cities representing over 600 million people. Mayor Philip Levine of Miami Beach signed on to the Compact in September 2015.

In order for Miami Beach and other cities apart of the Compact to track their progress towards reducing emissions, it is imperative to create a GHG inventory. Annual inventories can be compared to the baseline to help establish reduction targets, and is an important component of the Miami Beach Rising Above Resiliency Strategy.

Methodology



Tool used to compile inventory: ClearPath Software, developed by ICLEI, a global network of over 1,500 local and regional governments.

Greenhouse gas emissions are calculated using variables to convert input data into volumes of greenhouse gases emitted. These variables are factor sets, and are created for Transportation, Waste Characterization, and Grid Electricity.

Data was collected from various city departments and outside organizations, and entered into ClearPath. Data Gathered included:

- RESIDENTIAL ENERGY**
 - Grid Electricity for Residential Use (kWh, FPL)
 - Stationary Fuel Combustion for Residential Use (Therms, TECO)
- COMMERCIAL ENERGY**
 - Grid Electricity for Commercial Use (kWh, FPL)
 - Stationary Fuel Combustion for Commercial Use (Therms, TECO)
 - Grid Electricity for Public Street & Highway Lighting (kWh, FPL)
 - Grid Electricity from Other Sales (kWh, FPL)
- INDUSTRIAL ENERGY***
 - Grid Electricity for Industrial Use (kWh, FPL)
- TRANSPORTATION**
 - Total Miles Travelled Within City Boundary (2016, VMT, FDOT)
- WATER AND WASTEWATER**
 - Emissions from the Combustion of Digester Gas (MT CO_{2e}, population-based ICLEI calculator)
 - Emissions for Process N₂O from Effluent Discharge (kg N/day, MDC WASD)
- SOLID WASTE***
 - Waste generation (tons, FDEP)

Using the factor sets, this program converts the input data into the output of GHG emissions through various calculations. Final results are in the form of CO_{2e}, the sum of greenhouse gases after a greenhouse warming potential (GWP) is applied to non-CO₂ gases. The GWP is applied to all GHG's in order to present them in a standard unit that indicates their relative strength of the greenhouse effect they have on the atmosphere.

The Global Protocol for Community-Scale GHG inventories separates all emissions into 3 scopes:

- Scope 1:** GHG emissions from sources within the city boundary
- Scope 2:** GHG emissions used within the city but generated outside city boundaries.
- Scope 3:** GHG emissions occurring outside city boundary from third-party service being provided to the city.

All cities must follow this protocol within the Global Covenant of Mayors to create a uniform system of accounting.

Limitations

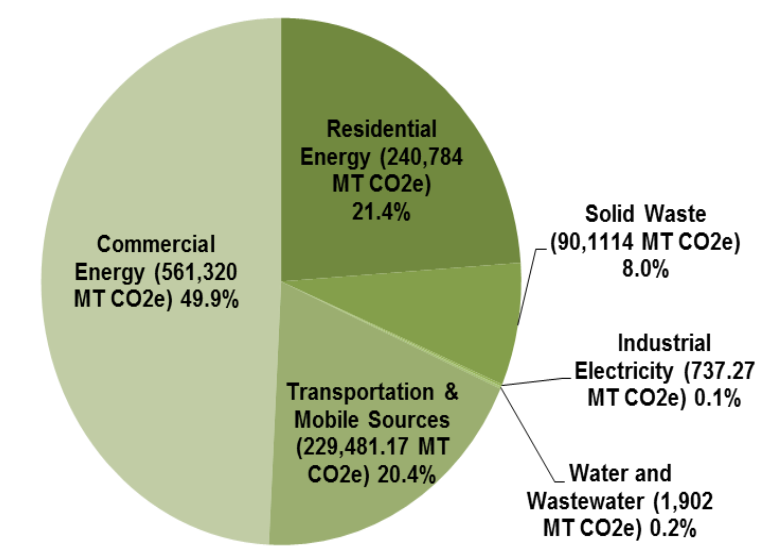
In addition to the community wide inventory, the city has compiled a government inventory in order to track government GHG emissions compared to the community as a whole. The most difficult hurdle when compiling these inventories is gathering data from various sources since the city does not own all of the data needed for an inventory. Each agency tracks and stores data differently, and staff turnover can cause inconsistencies in data assimilation. In this case, we are still working with one of our utilities to receive data necessary to complete the government inventory.

References

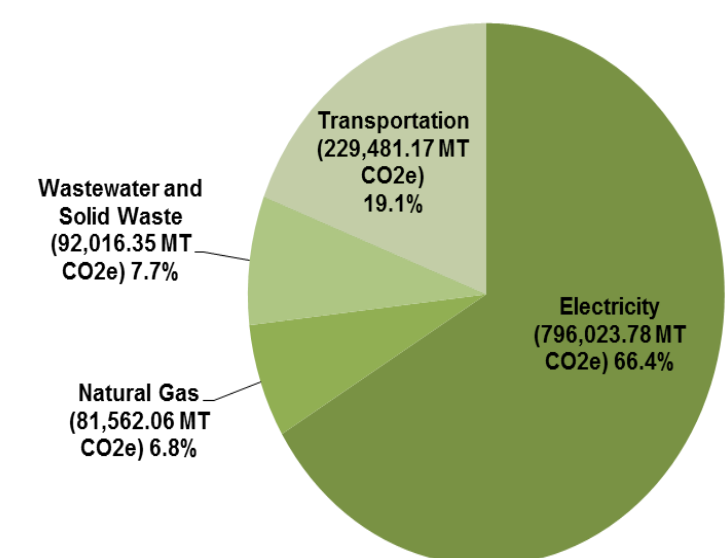
Ruddiman, W.F. (2008). Earth's Climate: Past and Future. 2nd ed.
U.S. Environmental Protection Agency (2009). Opportunities to Reduce GHG emissions through Materials and Land Management Practices. p.4-5.
Intergovernmental Panel on Climate Change. Fourth Assessment Report (AR4). p. 30.

Results

2016 Community Inventory by Sector



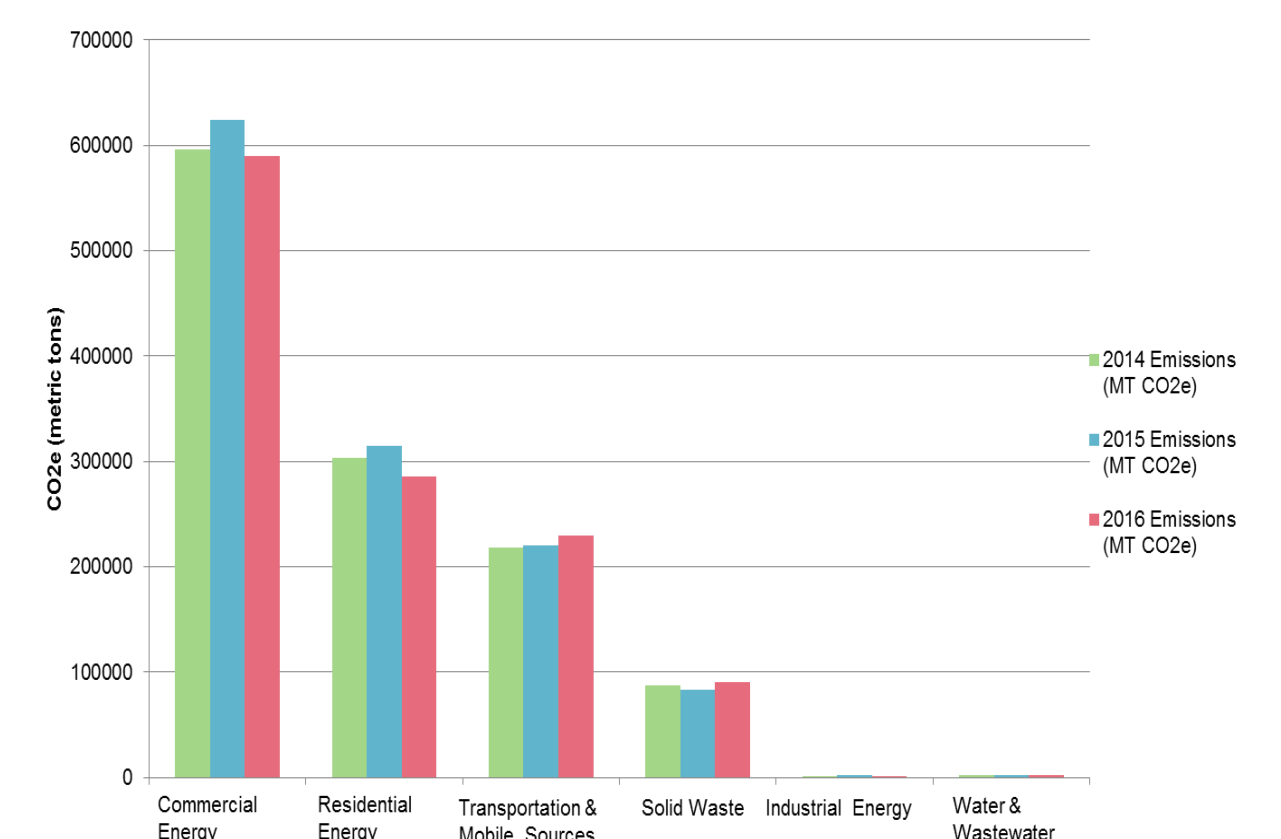
2016 Community Inventory by Source



According to the EPA equivalency calculator, total emissions from Miami Beach in the year 2016 is equivalent to:

- GHG emissions from 2,938,928,922 miles driven by an average passenger vehicle
- CO₂ emissions from 1,311,907,002 pounds of coal burned
- CO₂ emissions absorbed by 65.4% of the Everglades in one year

Trend by Sector: Baseline (2014)-2016



COMMUNITY INVENTORY	2014 Baseline Emissions (MT CO _{2e})	2016 Emissions (MT CO _{2e})	% Change
Commercial Energy	596,040.51	589,758.73	-1.05%
Residential Energy	303,165.11	286,182.98	-5.60%
Transportation & Mobile Sources	217,766.15	229,481.17	5.38%
Solid Waste	87,128.22	90,114.36	3.43%
Industrial Energy	1,417.60	1,644.13	15.98%
Water & Wastewater	1846.43	1,901.99	3.01%
Total Emissions	1,207,364.02	1,199,083.36	-0.69%

Conclusion

Compared to the baseline inventory, we are seeing an overall decline in community-wide emissions, especially within the residential sector. In terms of source, there is a declining trend in electricity use, despite an increase in population. Based on the results of this inventory, it will be necessary to focus attention on electricity and transportation sources when developing emission reduction targets, especially within our commercial and residential sectors.

When comparing our results to the U.S. average per capita, we have found that the average Miami Beach resident is accountable for 13.05 MT CO_{2e} per year compared to the average American resident who contributes 16.5 MT CO_{2e} per year.