



City of
EvanstonTM

Community Greenhouse Gas Inventory and Forecast

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INTRODUCTION

Background

The latest report on climate change from the Intergovernmental Panel on Climate Change (IPCC), released in the fall of 2007, concludes that “the evidence of a warming trend is “unequivocal,” and that human activity has “very likely” been the driving force in that change over the last 50 years” (IPCC 2007).

The IPCC was established by the World Meteorological Organization (WMO) and United Nations Environment Program (UNEP) in 1988 to give policymakers an objective source of information about the causes of climate change, its potential environmental and socio-economic consequences, and the adaptation and mitigation options to respond to it.

In 1994, the United Nations Framework Convention on Climate Change (UNFCCC), an international treaty, was established to provide a framework for intergovernmental efforts aimed at tackling climate change. The UNFCCC recognizes that the climate system is a universally shared resource that is affected by the increased presence of greenhouse gas emissions due to industrial processes and fossil fuel combustion. The treaty was ratified by 192 countries.

Three years after the UNFCCC was established, the Kyoto Protocol was adopted. The Kyoto Protocol, an international and legally binding agreement to reduce greenhouse gas emissions worldwide, entered into force in February 2005. The Protocol shares the objective and institutions of the UNFCCC, however, while the Convention encouraged developed countries to stabilize greenhouse gas emissions, the Protocol commits them to do so. The Kyoto Protocol is considered to be the most far-reaching agreement on environment and sustainable development ever adopted. While most of the world’s countries agreed to the Protocol, the United States chose not to ratify it.

The Kyoto Protocol is generally seen as an important first step towards stabilizing greenhouse gas concentrations at a level which will avoid dangerous climate change. As a result of the Protocol, governments have already put, and are continuing to put legislation and policies in place to meet their commitments; a carbon market has been created; and more and more businesses are making the investment decisions needed for a climate-friendly future.

In response to the United States decision not to ratify the Kyoto Protocol, Seattle Mayor Greg Nickels established the US Mayors Climate Protection Agreement, an initiative to advance the goals of the Kyoto Protocol through city leadership and action. Two years later, the U.S. Conference of Mayors launched the Mayors Climate Protection Center to administer and track the agreement, among its other activities. By November 1, 2007, there were more than 710 signatories to the Agreement.

Under the Agreement, participating cities commit to take the following three actions:

- Strive to meet or beat the Kyoto Protocol targets in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns;
- Urge their state governments, and the federal government, to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol -- 7% reduction from 1990 levels by 2012; and
- Urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system

In October of 2006, the Mayor of Evanston joined hundreds of other US cities and signed the US Mayor's Climate Protection Agreement. Months later, the City of Evanston began the process of collecting and assembling data to compile a community wide greenhouse gas emissions inventory. This report is a summary of the process undertaken to determine Evanston's estimated greenhouse gas emissions, the basis for developing a community Climate Action Plan.

The purpose of the inventory is to gain insight into which Evanston activities and sectors produce greenhouse gases. This will allow the City to more effectively target our greenhouse gas reduction activities and provide a baseline from which to measure emission reduction progress in future years.

Methodology

While methods vary slightly depending on individual city, county and state characteristics, community greenhouse gas emission inventory protocols all adhere to the same scientific guidance provided by the IPCC when assembling a community inventory. The primary greenhouse gases measured in a community inventory are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF₆). CO₂, CH₄ and N₂O are all naturally occurring greenhouse gases, while PFCs, HFCs and SF₆ are solely a product of industrial processes. Given CO₂, CH₄ and N₂O are all naturally occurring greenhouse gases, necessary for balancing the energy transfers between the atmosphere, space, and oceans, a community inventory measures the estimated greenhouse gas emissions that result from human activities.

The predominant source of CO₂ emissions is the burning of fossil fuels through the generation of electricity, natural gas and motor fuel use. A small amount of CH₄ and N₂O is also released from these activities. Additionally, CH₄ and N₂O are also produced through agricultural processes and wastewater treatment and CH₄ is released from landfills.

Evanston's greenhouse gas emission inventory tracks energy and waste related activities in the community, and calculates the relative quantities of greenhouse gases produced by each activity and sector. Accurate data was not available for the measurement of

PFCs, HFCs and SF₆, and subsequently, CO₂, CH₄ and N₂O are the only gases measured in this inventory. Nationally, PFCs, HFCs and SF₆ represent only 1.6% of the country's total emissions (US Greenhouse Gas Emissions and Sinks 1990-2002, 2004). CO₂ represents 83.5% of U.S. emissions while CH₄ and N₂O account for 14.8%, with the largest sources of CH₄ and N₂O related to agricultural practices.

The inventory performs two assessments: a communitywide assessment and a separate inventory of local government facilities and activities. Using a baseline year of 2005, the inventory calculated projected greenhouse gas emissions, which would be produced in the future if the community were to implement no emission reduction measures. This could be considered the "business as usual" scenario.

In order to adhere to the guidelines of the US Mayor's Climate Protection Agreement, the Evanston inventory also "backcasted" to calculate its estimated 1990 emissions. 2005 was selected as the baseline year because it was the earliest year that consistent, reliable data could be collected.

Calculating Evanston's Greenhouse Gas Emissions

The greenhouse gas emissions associated with the energy and waste inputs tracked through Evanston's inventory are all converted to their carbon dioxide equivalent (CO₂e) emissions.

While CO₂ is not as potent a greenhouse gas as the other greenhouse gases measured, its effect dwarfs all the other greenhouse gasses combined because it is produced in such large quantities. Therefore, greenhouse emissions are reported as though they were equivalent to a given volume of CO₂. Using CO₂e as a measure of greenhouse emissions allows for a comparison of the greenhouse impact of a variety of greenhouse emissions sources.

The emissions coefficients and methodology used in the Evanston inventory are consistent with the standards established by the IPCC and the U.S. EPA. Appendix C provides an overview of the emission coefficients and sources used in the Evanston inventory for emissions calculations.

The community wide analysis performed includes electric and heat- fuel emissions for the residential and commercial (includes industrial) sectors, transportation emissions and waste emissions. The local government inventory includes an analysis of electrical, heat and motor fuel related emissions.

The data collected came from a variety of sectors and sources, including the City of Evanston, Commonwealth Edison and Nicor Gas. Most data collected for the baseline inventory is from the calendar year 2005. Some data, however, is from the fiscal year 2005- 2006. Data sources and calculations are provided in Appendixes A through C.

Evanston will continue to use the methods identified in this report to track its emissions and emission reducing measures over time, making adjustments as the IPCC and US EPA make further refinements to their protocols.

Greenhouse Gas Emissions Inventory Summary

In the base year 2005, the community of Evanston generated an estimated 996,672 metric tons of CO₂ equivalent emissions. As Table I exhibits, the largest portion of greenhouse gases came from the commercial sector, followed by the residential sector, transportation and waste.

2005 Evanston	
Source	MTCO ₂ e
Electricity - Residential	156,426
Electricity - Commercial	370,530
Electricity - Rail	19,016
Natural Gas - Residential	114,674
Natural Gas - Commercial	224,266
Gasoline	99,664
Diesel	25,869
Solid Waste Landfilled	9,709
Organic Waste Composted	-898
Mixed Recyclables Recycled	-22,584
TOTAL	996,672

Table I. Evanston Community Greenhouse Gas Emissions by Source, 2005.

The commercial sector contributed 370,530 metric tons of CO₂e as a result of electric consumption and 224,266 metric tons of CO₂e from natural gas consumption to Evanston's community emissions. Included in the commercial sector emissions are Evanston's industries, institutions, offices, and retail businesses. Evanston is home to Northwestern University, which has a student body of almost 15,000 students, two major hospitals, two school districts, a research park and a growing downtown. The commercial sector accounts for an estimated 25 to 30 million square feet of buildings (City of Evanston GIS Division, 2008), which makes up about one third of Evanston's built environment and 21.5% of Evanston's land use (City of Evanston Planning Division, 2005). Evanston businesses provide over 38,000 jobs (US Census, 2000), almost half of which are concentrated in the fields of education and health care (IL Department of Employment Security, 2004 and 2005).

Industrial emissions were included in the commercial sector emissions. The portion of emissions attributed to industrial processes is assumed to be low; Evanston has 52 industrial firms (as of 2004) and the total gas use reported for 2005 represented only 2.5% of the combined industrial and commercial accounts (separate electric data was not available). Based on trends observed in the past 15 years, the forecast for industrial uses in Evanston is the retention and limited expansion of many small industrial firms

and the departure of other industrial uses due to buyouts, lack of succession ownership or the need to relocate to larger or more convenient locations. Several factors are attributed to this forecast, including high land costs which are bid even higher by residential developers coveting industrial land for reuse, high property taxes in Cook County and accessibility challenges. It is anticipated that a number of former warehouse and industrial properties will be converted to residential lofts, live/work spaces or multi tenant commercial developments which will include jewelry makers, designers, culinary commercial kitchens and consulting firms (City of Evanston Planning Division, 2005).

Emissions from the residential sector were the second largest contributor of Evanston's community greenhouse gas emissions, with 156,426 metric tons of CO₂e attributed to electric use and 114,674 metric tons of CO₂e attributed to natural gas use. In the 2000 Census, Evanston's population was 74,239. The City of Evanston has experienced modest growth since 1990. This has reversed a declining trend from a peak population of 80,113 in 1970, and is expected to continue. The 2004 Census population estimate of 74,811 indicates that the growth trend is continuing (US Census, 1970, 1990, 2000 and 2004).

Residential land-use accounts for 44.5% of Evanston's total land use (City of Evanston Planning Division, 2005) and almost 60 million square feet of Evanston's built environment (City of Evanston GIS Division, 2008).

The community inventory only includes emissions from electric and natural gas consumption. Commercial and residential sector consumption of propane and heating oil were not included due to the lack of reliable consistent data for these fuels. Census data shows 95% of Evanston homes are heated with natural gas (81.8%) or electricity (12.8%) (US Census, 2000). Based on this data, the emissions attributed to propane and heating oil are assumed to be very low for the commercial and residential sectors of Evanston.

The community greenhouse gas emissions attributed to transportation total 99,664 metric tons of CO₂e from gasoline consumption and 25,869 metric tons of CO₂e from diesel. Community mobile fuel data was collected through City of Evanston motor fuel tax records from FY 2006 (March 2005-February 2006), which accounts for total number of gallons of fuel sold at all of the gas stations located within the borders of Evanston. There are 14 gas stations in Evanston.

The data unfortunately did not differentiate between gasoline, diesel, ethanol or bio-diesel. The division of total gallons of motor fuel between gasoline and diesel was assumed based on IL fuel consumption data from 2005 and 2006. Based off of this average consumption it was assumed that 81.5% of the total gallons sold were gasoline and the remaining 18.5% was diesel.

Located on the border of Chicago, Evanston enjoys the benefits of an extensive public transit system, including an electric rail line, a commuter rail line and both public and

private buses. Due to various data collection challenges, the transit data collected was limited to electric rail. Electric rail accounts for 19,016 metric tons of CO₂e.

Evanston’s waste sector represents the smallest amount of the community emissions, with 9,709 metric tons of CO₂e due to the disposal of solid waste. The total tons of refuse, yard waste and recycling accounted for in the inventory are limited to the residential sector, Northwestern University (refuse and recycling only), the two school districts (recycling only), the City of Evanston and the City’s recycling center (recycling only), which collects recyclable materials from residents and businesses at no charge. With the exception of Northwestern University, all of the entities included are serviced by either the City’s refuse collection service or recycling contractor and the tonnage by entity can not be separated out. Additionally, commercial waste is collected by anywhere from 10 to 15 different haulers, making it extremely difficult to accurately determine the tonnage of waste generated by this sector.

2005 City of Evanston	
Source	MTCO₂e
Electricity	17,804
Natural gas	3,975
Gasoline	1,321
Diesel	1,398
Biodiesel	278
TOTAL	24,776

Table 2. Evanston Municipal Greenhouse Gas Emissions by Source, 2005.

Emissions were calculated separately for City of Evanston operations. Again, electric use accounted for the highest amount of greenhouse gas emissions. The City owns and operates about 50 buildings, representing over 2.1 million square feet. Approximately half of the City’s electric consumption is tied to operations at the City’s water plant, which treats and delivers drinking water to its residents and 5 other neighboring communities. Another big portion of the City’s electric use is attributed to the operation of street lights and signals.

The City’s fleet has been running on 20% biodiesel (B20) since 2004, which was accounted for in the inventory. Transportation emissions for the City’s operations account for 10% of the City’s total emissions. Overall, the City’s emissions account for 2-3% of the combined community and City emissions (Chart 1).

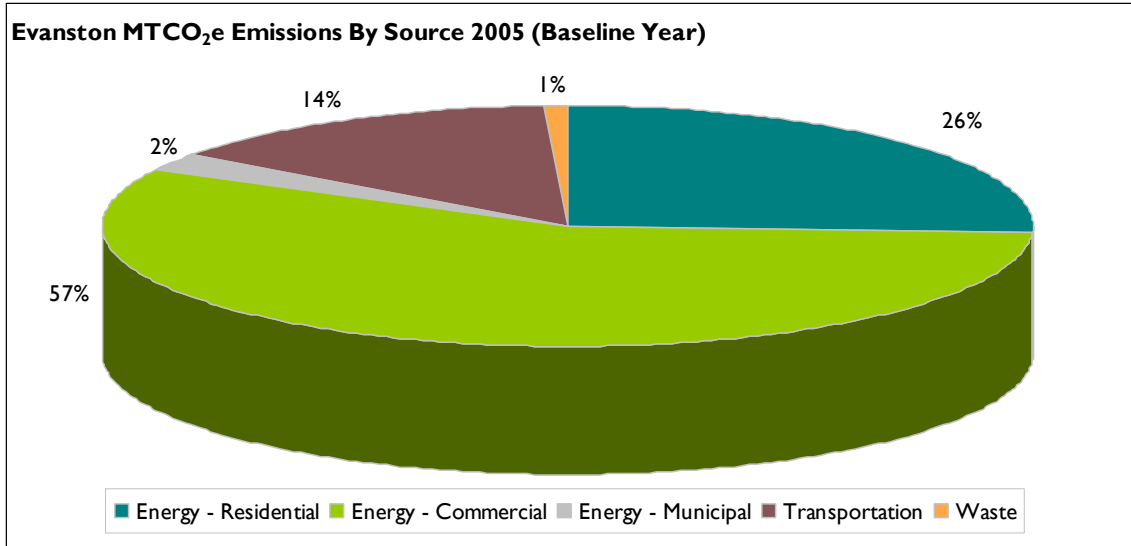


Chart I. Evanston Greenhouse Gas Emissions by Source, 2005.

Total baseline emissions, for the community and the City of Evanston, are estimated at 1,021,448 metric tons of CO₂e, or 13.6 metric tons of CO₂e per capita. The commercial energy consumption accounts for the largest portion of Evanston’s greenhouse gas emissions, with 57% of the total emissions. Residential energy consumption is the next largest portion of Evanston’s greenhouse gas emissions, at 26%. Transportation only accounts for 14% of Evanston’s total greenhouse gas emissions, which, due to the limited data available for use in the inventory, is assumed to be represented as much lower than actual. Based on the percentage of emissions that transportation accounts for in Chicago (21%) and the region (31%), Evanston’s transportation emissions could be as high as double what they are represented here. According to the 2000 census, 18.4% of Evanston residents commute to work by transit, 61.7% drive to work, 11.7% walk to work and 6.1% work from home. Efforts to obtain more accurate data will continue as data is collected in the years to come.

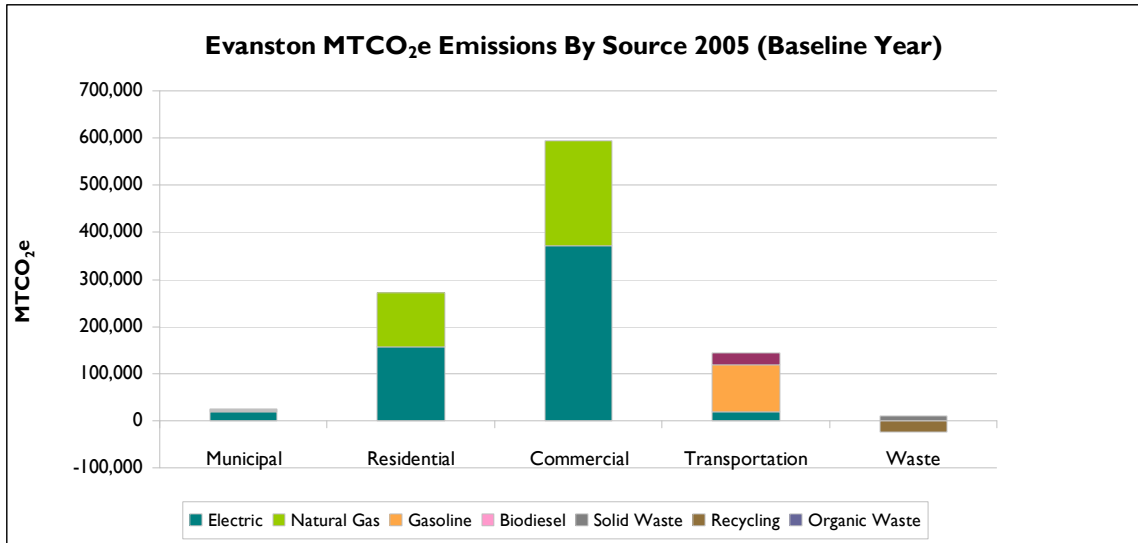


Chart 2. Evanston Greenhouse Gas Emissions by Source, 2005.

A breakout by sector of the emission sources shows electricity accounts for more than half of the total energy emissions in the commercial, residential and municipal sectors (Chart 2). Gasoline is the primary source of emissions in the transportation sector.

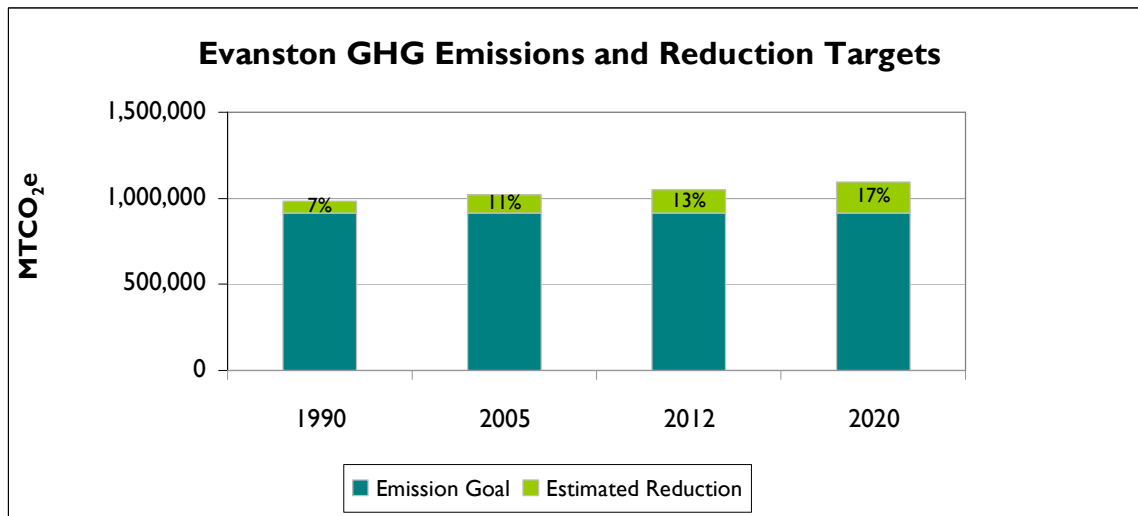


Chart 3. Evanston Greenhouse Gas Emissions and Reduction Targets.

Based on the 2005 emissions, a 13% reduction is needed to reduce emissions 7% below the 1990 levels (Chart 3). 1990 and 2020 numbers were estimated based on US Department of Energy historical data and projections, US Census population data and projections and the Chicago Metropolitan Agency for Planning population projections. Evanston’s population has experienced modest growth since 1990, from 73,233 in 1990 to 74,811 in 2004, and is expected to continue to experience an increase in population, estimated at an average annual growth rate of .3%. A 13% reduction in greenhouse gas

emissions by 2012 is an estimated 140,104 metric tons of CO₂e, or approximately 1.9 metric tons of CO₂e per capita.

In summary, Evanston produced an estimated 1,021,448 metric tons of CO₂e in the baseline year 2005. Based on the data collected in 2005, an estimated 140,104 metric tons of CO₂e, or a 13% reduction in greenhouse gas emissions, needs to be achieved to meet the goal outlined in the US Mayor's Climate Protection Agreement. This reduction on reflects the goal outlined in the US Mayor's Climate Protection Agreement. Long term, many now suggest an 80% reduction in current greenhouse gas emissions needs to be achieved by 2050 to mitigate the effects of climate change.