City of Duluth

Greenhouse Gas Emissions Inventory and Forecast 2008

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2008 Duluth GHG Inventory

Executive Summary

The Duluth Greenhouse Gas (GHG) Emissions Inventory and Forecast 2008 is the second GHG inventory tabulation and report for the City of Duluth Minnesota. The first report was prepared in 2001 to benchmark 1996/1999 (1996 for municipal operations and 1999 for community emissions) GHG emissions.

The City of Duluth was an early leader in measuring its GHG, having joined ICLEI – Local Governments for Sustainability USA (ICLEI) in 2001. ICLEI (formerly the International Council for Local Environmental Initiatives) is a member organization comprised of over 600 local governments in the United States. As part of its commitment to ICLEI, Duluth compiled a greenhouse gas inventory for both municipal operations and the community as a whole in 2001.

The 2001 inventory effort led to the formation of the Mayor's Citizens Climate Protection Campaign (CCP) Advisory Committee (Committee), which has remained in force since that time. The Committee is designed as a resource for City staff, and it is intended to provide direction and support to City efforts to reduce energy consumption and therefore reduce GHG emissions.

Although the committee remained active throughout the last decade, budget limitations and frequently changing staff priorities limited the City's efforts to a certain degree.

In 2009, energy efficiency and conservation grant funding was provided for by passage of the American Reinvestment & Recovery Act of 2009 (ARRA). To coincide with the Energy Efficiency and Conservation Block Grant (EECBG) Program – Formula Grant award, the City secured a complementary grant for the second GHG inventory tabulation of Year 2008 emissions data and chose to commission a comparison of the 2001 inventory with 2008 data.

The EECBG Program Formula Grant funds were used to pay for energy audits for 86 city owned building and facilities, performed by a professional energy audit service company. These program funds were also used to hire an energy coordinator who will develop and implement a plan for energy efficiency and conservation in city-owned facilities.

Inventory Results

As with the 2001 report, emissions inventories were conducted for both municipal operations and for the community as a whole. In both cases, 2008 shows an increase over the emissions reported in the 2001 report.

Municipal operations emissions increased from 126,370 tons carbon dioxide equivalent (CO_2e) in 1996 to 154,386 tons CO_2e in 2008. The vast majority of that increase comes from the Steam Plant, although there were also increases in emissions associated with buildings and facilities as well as water delivery systems. Vehicle fleet emissions were

reduced in 2008 relative to 1996. Figure ES-1 below compares 1996 emissions to 2008 emissions by sector.

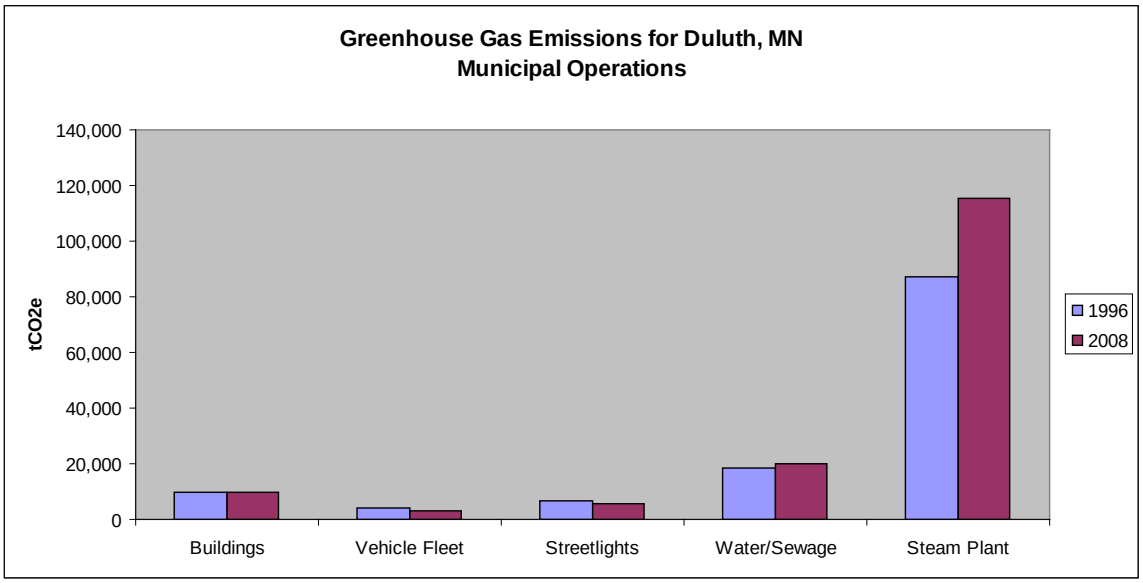


Figure ES-1. Greenhouse gas emissions for Duluth, MN. Emissions were calculated using ICLEI's CACP software.

The overall percent contribution of the steam plant increased significantly between 1999 and 2008, from 69% to 75%. The relative contributions of the other sectors (buildings, fleet, streetlights and water/sewage) remained essentially the same. Figure ES-2 shows the emission break down emissions for 2008 for municipal operations.

Steam Plant

The coal-fired plant, which is owned by the city of Duluth and operated by Duluth Steam Cooperative Association, supplies steam to more than 200 downtown buildings via 10 miles of high-pressure lines. The Steam Plant is by far the most significant contributor to the City's operational GHG emissions. Emissions from the Steam Plant increased significantly from 1996 to 2008, due primarily to the increased use of coal in place of natural gas. The higher GHG emissions from coal combustion versus natural gas combustion explain the bulk of change in emissions from 1996 versus 2008.

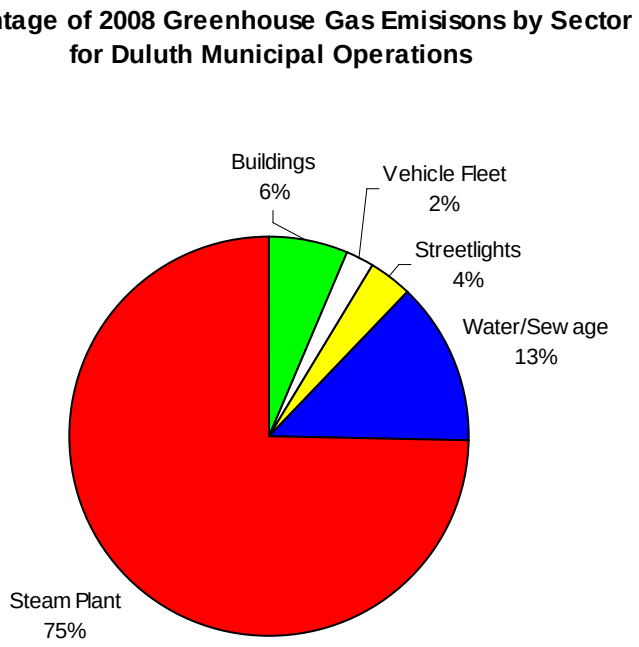


Figure ES-2. Relative sector contribution to total greenhouse gas emissions for Duluth, MN for 2008.

Community emissions increased as well, from 2,322,834 CO_2e in 1999 to 2,702,137 tons CO_2e in 2008, an increase of about 16%. As with municipal operations, there was some redistribution of emissions with the sectors. Figure ES-3 compares 1999 emissions to 2008 emissions:

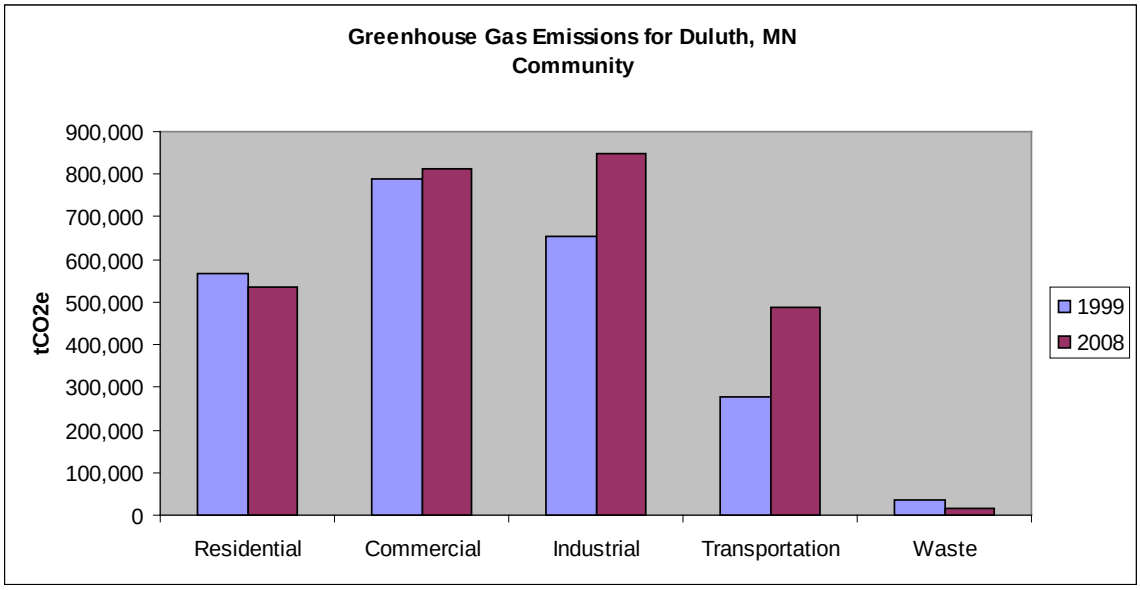


Figure ES-3 Community level greenhouse gas emissions for Duluth, MN for 1999 and 2008.

Community emissions in 2008 are spread amongst transportation, industrial, commercial, residential and waste sectors, as shown in Figure ES-4. Breakdowns are similar to those from 1999.

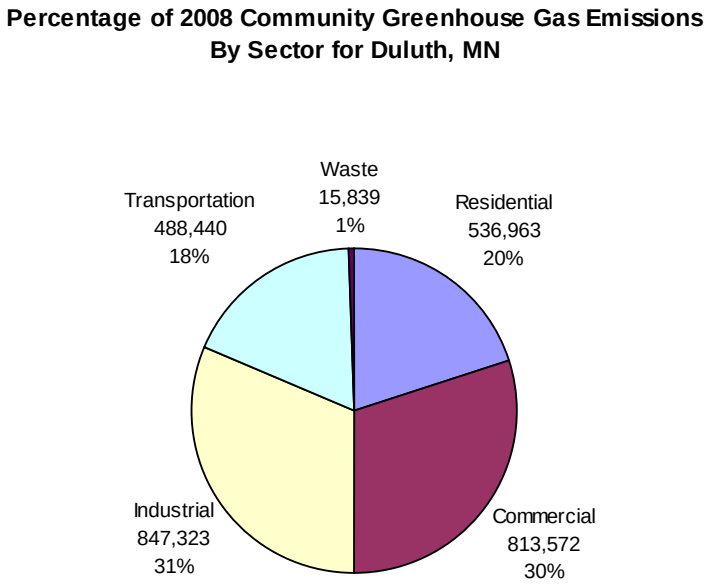


Figure ES-4 Community level greenhouse gas emissions by Sector for Duluth, MN for 2008.

GHG emissions for both municipal operations and the community as a whole increased between 1996/1999 and 2008. Without initiatives to reduce energy consumption or change sources, emissions are predicted to continue to increase into the future. Utilizing the energy and cost information compiled in this report, and the energy efficiency measures recommended in the 86 City building and facility assessment reports, the City of Duluth has an opportunity to identify energy-related cost-saving projects that will have the co-benefit of reducing GHGs.

The CCP Advisory Committee along with city staff have already begun the process of setting GHG emissions reduction targets and developing a local action plan, the next two steps in the ICLEI milestone process. The local action plan will detail strategies to meet reduction targets, and will identify specific opportunities for emission reduction through energy efficiency, energy conservation, waste reduction and renewable energy projects.

I. Introduction

Over the past two decades, scientific evidence for human-induced global warming has become increasingly more robust. The Intergovernmental Panel on Climate Change (IPCC) is a high-level collaborative body comprised of climate scientists from throughout the world. Its role is to assess the current state of climate change scientific research and summarize the findings of hundreds of climate scientists in a way that will allow policymakers and the public at large to make informed decisions. The IPCC issued its 4th Assessment Report in 2007. The main conclusion of the report is that the scientific evidence indicates that it is "very likely" that global temperatures are increasing and "very likely" that those changes are primarily caused by human factors.

Organizations in both the public and private sectors have taken notice. As such, organizations have started taking action to both reduce emissions that help drive global climate change and to begin to plan for adapting to unavoidable changes in climate over the coming decades. Companies ranging from small, local businesses to large, multi-national corporations have taken leadership roles in measuring and reducing greenhouse gas emissions. Governments at all levels – national, state, and local – have made commitments to implementing policies and making investments that will help reduce GHG emissions. Despite the lack of federal legislation in the U.S., significant efforts are underway in the U.S. and around the globe to mitigate GHG emissions.

The Climate System

The global climate system is complex and comprised of hundreds of constantly changing variables. Incoming solar radiation, humidity, cloud cover, atmospheric gas concentrations, physical geography, and numerous other factors all interact to give us dynamic weather and climate. This makes studying the climate a complex and challenging endeavor; consequently, predicting future climate changes relies on sophisticated models that must incorporate all of these climate variables. There is uncertainty in climate findings that will always be present, but the current state of climate science allows those uncertainties to be constrained to a significant degree.

It is important when discussing climate to recognize the difference between climate and weather. The term "weather" encompasses the day-to-day changes we see in sunshine, rainfall, humidity, cloudiness, temperature, etc. "Climate" refers to these same variables, but on longer time scales. Typically, a time period of at least 30 years is used to look at average changes in those variables listed above when discussing climate. In other words, we dress for the weather; we build our houses for the climate.

As global temperatures increase, regional weather and climate patterns will change. In the mid-latitudes, the frequency of high-intensity storms is expected to increase. Certain areas of the U.S. will see increases in drought, and others increases in floods. Global sea level will also increase, causing increased pressure on low-lying coastal regions, which are frequently highly populated. There are two responses to potential climate changes: 1) attempt to prevent it from happening and 2) prepare to adapt to coming changes. Both are

legitimate options, and both will cost money. The Stern Report[1], the most thorough economic analysis of the costs of mitigation versus adaptation indicates that adaptation will be significantly more expensive at a global scale.

Public Sector GHG Management

Global efforts to address anthropogenic (human influenced) climate change have increased dramatically over the past decade. The Kyoto Protocol, an international treaty designed to reduce global GHG emissions, came into effect in 2005. The Protocol required certain signatories to reduce emissions from 1990 levels by 2012. The Kyoto Protocol is currently in its final phase, and it is unclear whether another international treaty will come into effect before the Kyoto Protocol expires.

In regard to the U.S., which signed the Kyoto Protocol but never ratified it, efforts to manage and reduce GHG emissions have stalled, particularly at the federal level. In the middle of the last decade, numerous regional-level initiatives got under way, including the Regional Greenhouse Gas Initiative (RGGI), the Western Climate Initiative (WCI), and the Midwestern Greenhouse Gas Accord (MGGA). RGGI and the WCI have both continued to progress, but the MGGA was put on hold, as it appeared beginning in late 2007 that efforts at the federal level were beginning to gain momentum. The prospects of a comprehensive climate bill at the federal level are slim, although smaller energy-related bills are a possibility.

Noting the lack of legislation at the federal level, local governments have become increasingly active in their efforts to measure and manage GHGs. These efforts are primarily on a “voluntary” basis – there is no legislation or regulation compelling the efforts. Of note is the U.S. Conference of Mayors’ Climate Protection Agreement, under which cities vow to reduce their GHG emissions below 1990 levels, consistent with the Kyoto Protocol. Currently, over 1000 mayors have signed the Climate Protection Agreement.

In addition, city-level sustainability efforts are becoming more and more common, with Sustainability Directors/Coordinators/Managers becoming an increasingly common city staff position. Climate protection efforts typically fall under these larger sustainability efforts, and a community of sustainability-minded cities is working to share successes, lessons learned and best practices.

One of the keys to making GHG mitigation efforts viable are the co-benefits associated with managing energy. The primary co-benefit is related to the fact that energy and GHG emissions are very closely related. Therefore, by managing carbon, local governments are also able to manage energy across varying sources using comparable metrics. Reductions in GHG emissions typically result from reductions in energy consumption, which in turn results in a reduction in expenses. GHG management helps organizations save money.

In addition, GHG management forces organizations to look at their fuel use and identify opportunities to move away from volatile global sources of fuel. Organizations tend to be particularly interested in identifying local renewable energy sources whose use can result in local job growth and an increased tax base. In Duluth, for example, there are opportunities to look at locally-sourced woody biomass as an alternative to coal. Utilizing local biomass could provide local landowners and businesses an avenue through which to enter the renewable energy markets.

City of Duluth Previous Efforts

The City of Duluth was an early leader in measuring its GHG, having joined ICLEI back in 2001. ICLEI (formerly the International Council for Local Environmental Initiatives) is a member organization comprised of over 600 local governments in the U.S. ICLEI's Cities for Climate Protection program enables cities to employ a five milestone process for managing its GHG emissions: 1) create a GHG inventory; 2) set a GHG emission reduction target; 3) develop a local action plan; 4) act on the local action plan; and 5) reevaluate and asses efforts.

As part of its commitment to ICLEI, in 2001 Duluth compiled a GHG inventory for both municipal operations and the community as a whole, thus completing Milestone 1 of the ICLEI process. That inventory effort led to the formation of the Citizens Climate Protection campaign (CCP) Advisory Committee (Committee), which has remained in force since that time. The Committee is designed as a resource for City staff, and is intended to provide direction and support to City efforts to reduce energy consumption and therefore reduce GHG emissions.

The 2001 effort (which covers 1996 for the community and 1999 for municipal operations) was impressive, especially considering the lack of a standardized framework and methodology for developing city-wide GHG inventories at that time. Significant efforts have been made in recent years to standardize municipal GHG inventories, particularly with the development of the Local Government Operations Protocol (LGOP). This protocol clearly defines the sources to be included in an inventory along with methods for gathering appropriate data to calculate those emissions. There is still no protocol for inventorying community-wide emissions, although ICLEI USA is in the process of developing such a protocol.

II. Emissions Inventory

The following pages describe the methodology for developing the 2008 inventory, the results of the inventory, and comparisons to the 2001 effort. The goal of this section is to not only describe the current inventory, but also to facilitate future inventory efforts.

Methodology

Protocol

The current inventory was conducted under the guidance of the LGOP. The LGOP was developed by four leaders in GHG management: ICLEI USA, the California Air Resources Board (CARB), The Climate Registry, and the California Climate Action Registry (CCAR). The LGOP is consistent with the World Resource Institute (WRI)/World Business Council for Sustainable Development (WBCSD) GHG Protocol, which is the basis for all of the major GHG accounting protocols. The LGOP is widely accepted across local governments as the standard GHG accounting protocol, and it allows comparisons of GHG inventories from one city to another.

The protocol is designed to aid in the identification of GHG sources and the appropriate data to use to calculate emissions from these sources. This inventory follows the LGOP for municipal operations unless otherwise noted for a particular source. Sources included cover all Scope 1 and Scope 2 emissions, which are defined below. The community inventory follows the methods from the 2001 inventory in order to maintain comparability between the two reports.

Scope 1 (“Direct”) emissions are emissions from sources within the local government’s organizational boundary that the local government owns or controls. These emissions are generally broken down into:

- Stationary combustion
- Mobile source combustion from vehicles owned/controlled by the municipality
- Process emissions
- Fugitive emissions

Scope 2 (“Indirect”) emissions are emissions resulting from and associated with the purchase and use of imported electricity and steam.

Scope 3 (“Other Indirect”) are all other emissions associated with local government operations, but outside of the direct control of the local government. Emissions such as employee commuting, employee business travel and supply chain emissions are all Scope 3 emissions, and are optional under all reporting schemes. Much of the community level GHG emissions are considered Scope 3, and will be discussed below.

Gases included in the LGOP and in this analysis include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Based on their respective global warming potential (GWP), all gases are converted to and reported in units of tons of CO_2-equivalent (CO2e). The GWP of each GHG this takes into account the different heat-trapping properties and atmospheric residence times of the different gases.

Software

The inventory is calculated using the Clean Air and Climate Protection (CACP) 2009 Software, Version 2.2.1b, April 2010. The CACP software was originally designed for ICLEI USA by Torrie-Smith Associates. Development was made possible, in part, by a grant from the U.S. Environmental Protection Agency (USEPA). This current version of the CACP software has been updated with the specific intent of being consistent with the methodologies outlined in the LGOP.

Data Sources

Potential emission sources were identified using the 2001 inventory as a starting point and further developed in ongoing conversations with city staff. It is believed all potential emissions sources were identified, although it is possible some small sources were overlooked.

Once emission sources were identified, city staff aided in identifying potential sources for data related to those emission sources. The 2001 inventory again proved useful in identifying potential people or departments where data might be available. Minimizing staff time was made a priority, and therefore parallel data collection efforts were leveraged wherever possible. This was particularly true in the case of building energy use, where the recently conducted B3 survey collected energy data at most major City buildings; and at the steam plant, where a recent report to the Minnesota Pollution Control Agency (MPCA) required the steam plant to collect all 2008 data.

Some notable sources of emissions were excluded from either the municipal or community level inventories. Emissions from the Western Lake Superior Sanitary District (WLSSD) were excluded from municipal operations (but included in community emissions). The LGOP specifically excludes such “Special Districts” from Scope 1 and Scope 2 emissions inventories for municipalities.

A specific list of contacts and emission factors is included as Appendix A and a detailed description of the input data and calculations is included as Appendix B.

Inventory Results

Community Emissions

GHG emissions from within a geopolitical boundary such as a city come from a wide variety of sources. Major sources of emissions include commercial and industrial activities, city residents, travelers and freight passing through city borders, and waste produced and disposed of within the community. Emissions derive primarily from the burning of fossil fuels – coal, natural gas, fuel oil, gasoline, and diesel. Additional emissions occur from the anaerobic decay of organic waste, where organic carbon is converted into methane, which has a GWP 21 times higher than carbon dioxide.

Because there is currently no protocol for conducting community-wide GHG inventories, and in order to allow comparisons with the 2001 report, the 2008 inventory closely follows the methods from the 2001 report. Details of the sources, data collected, and calculations are listed in Appendix B. The community forecast results are located in Appendix C. The community GHG emissions calculations results output from the CACP software are located in Appendix D. The community-level inventory should be considered a rough estimate, as data can be difficult to obtain and is not always complete.

Duluth community emissions for 2008 are estimated at 2,702,137 tons CO_2e. Based on a population of 84,419 (2009 Census estimate), that equates to 32 tons CO_2e per capita, significantly higher than the national average of 24.5 tons. This is unsurprising considering the cold climate, the old building stock, and heavy reliance on coal for electricity generation.

Community-level emissions are broken into the following sectors:

- Residential
- Commercial
- Industrial
- Transportation
- Waste

Emissions for each sector are listed in Table 1. The commercial and industrial sectors make up the majority of community emissions, contributing a combined 61.5% of total emissions. Residential and transportation also make up a significant portion of the total, while waste contributes very little to overall emissions.

	Residential	**Commercial**	**Industrial**	**Transport**	**Waste**	**Total**
tons CO_2e	536,963	813,572	847,323	488,440	15,839	2,702,137
% of Total	19.9	30.1	31.4	18.1	0.6	100

Table 1. 2008 Community GHG Emissions for Duluth, MN

The primary sources of the community-scale emissions are electricity, natural gas, coal, and petroleum fuels (Figure 1). Electricity is by far the largest contributor to Community GHG emissions, with gasoline, natural gas and fuel oil also being significant contributors. The high percentage for electricity emissions is largely due to the high electricity emissions factor for the region, a function of the high rate of coal-powered electricity generation. For a breakdown of source within each sector, see Appendix D.

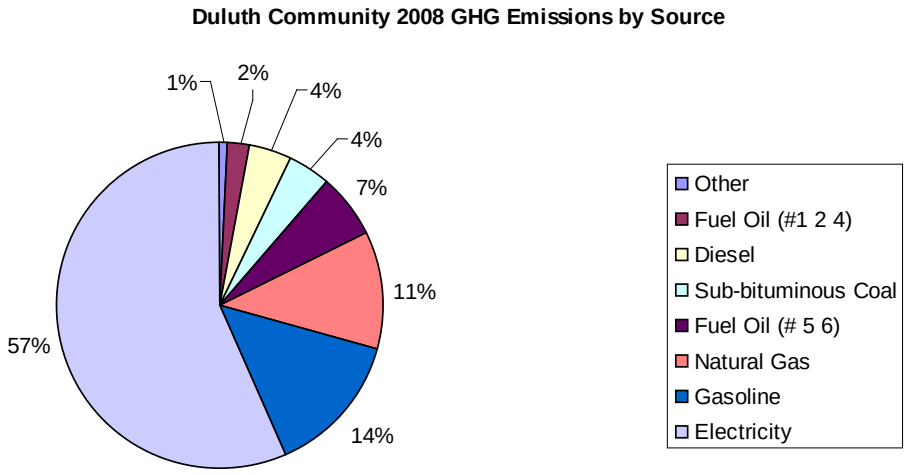


Figure 1. 2008 Community GHG Emissions for Duluth, MN

Community GHG emissions have increased since 1999, as discussed in more detail below. It is anticipated that they will continue to increase over the coming years and decades without significant GHG emission mitigation efforts.

Although economic growth and consumption predictions are difficult given the current state of the economy, GHG emissions were forecast for the year 2020. Economic growth factors are taken from the Energy Information Administration's Annual Energy Outlook 2009 with Predictions to 2030 (2009). .For the residential sector, electricity consumption is assumed to grow at 1% annually, natural gas at 0.4%. Fuel oil consumption is estimated to decline at 2.4% annually. For the commercial/industrial sectors, energy consumption is estimated to increase at 1% across all sources. Energy use for transportation is estimated at 0.5%.

Two forecasts are included to illustrate the potential effects of local initiatives to reduce energy use and emissions. The 2020 forecast predicts emissions based on the above growth factors. The 2020 with the Minnesota Renewable Portfolio Standard (RPS) forecast predicts emissions based on the above factors and accounting for potential effects from the RPS. Enacted in 2007, the Minnesota RPS requires that 25% of the state's electricity come from renewable sources. This initiative would decrease GHG

emissions by using less carbon-intense sources. Comparisons based on the two scenarios along with additional background are included in Appendix C.

The 2008 actual emissions, 2020 forecast, 2020 forecast with RPS, and the 2020 prediction from the 2001 report, are listed below in Table 2. Emissions are predicted to increase nearly 10% by 2020 without efforts to decrease energy consumption or use different sources.

	2008	**2020**	**2020 with RPS**	**2020 (from 2001)**
Tons CO_2e	2,702,137	2,962,811	2,631,588	3,162,471

Table 2. 2008 emissions and prediction of 2020 calculated based on 2008 data and the 2020 prediction from the 2001 GHG report.

Municipal Operations Emissions

Municipal government operations include all activities directly controlled both financially and operationally by the City of Duluth. Activities that result in GHG emissions include buildings, parks, street and signal lighting, vehicles, energy generation, water and wastewater management, and waste disposal.

The 2008 GHG emissions inventory for municipal operations includes all Scope 1 and Scope 2 emissions for the City of Duluth. Emissions from municipal operations are broken into the following sectors, as dictated by the CACP software:

- Buildings and facilities
- Streetlights & Traffic Signals
- Water/Sewage
- Vehicle Fleet

In addition, the Steam Plant is broken out as a separate building/facility due to its large overall contribution to municipal GHG emissions.

Scope 1 and Scope 2 emissions for municipal operations in 2008 totaled 154,386 tons CO_2e. The steam co-op is by far the largest contributor, with 75% of total GHG emissions. This is due to the fact that the co-op provides steam heat to a large number of buildings, and that the steam is generated primarily through combustion of coal, which has a high GHG emission factor. Total emissions by sector, along with % contribution to municipal operations emissions are shown in Table 3.

	Buildings and Facilities	**Steam Co-op**	**Streetlights & Traffic Signals**	**Water/Sewage**	**Vehicle Fleet**	**Total**
tons CO_2e	9,869	115,320	5,884	19,983	3,330	154,386
% of Total	6	75	4	13	2	100

Table 3. Municipal Operations Emissions by Sector

Municipal greenhouse gas emissions can also be considered by source. Sub-bituminous coal combusted at the steam co-op continues to be the largest single contributor to emissions by source. Electricity is second, followed by natural gas (Figure 2).

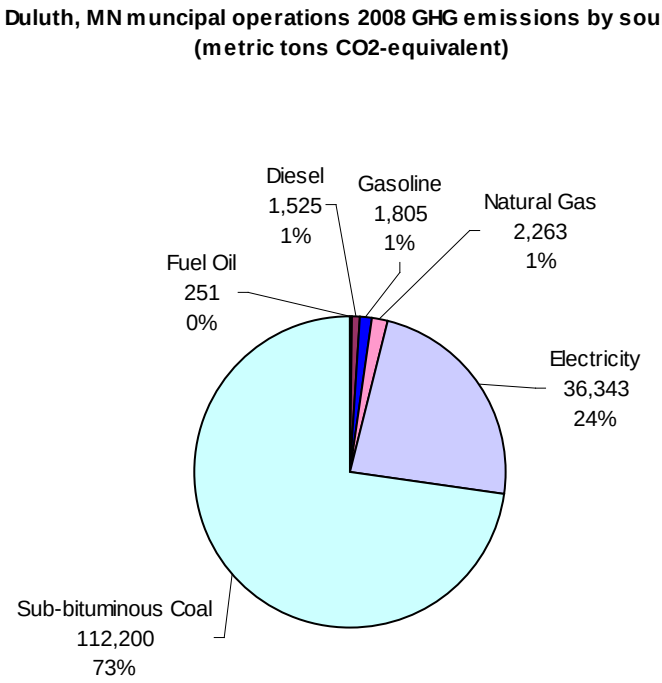


Figure 2. City of Duluth GHG emissions by source for 2008.

Within city operations, coal and electricity are clearly targets for reducing GHG emissions. It is important to note that 200 or more large commercial and municipal facilities are heated by the Steam Plant, so energy efficiency projects at those buildings have the potential for significant reductions in overall municipal operations GHG emissions. In addition, opportunities for fuel switching at the steam co-op – either to natural gas or to biomass – have the potential for major reductions in overall operational GHG emissions.

Tables of all the GHG estimated from the various sectors and sources are located in Appendix E.

Comparison with previous inventory

Municipal Emissions

Total emissions from municipal operations are about 22% greater in 2008 than they were in 1996, although emissions from several sources were significantly lower in 2008, as shown in Table 4 and Figure 3. The relative contributions of each sector remain approximately the same, although emissions from the steam plant contribute significantly more in 2008 than in 1996 (75% versus 69%). This is due to a combination of increased energy output as well as increase in the percentage of energy being generated through coal combustion.

	1996	**2008**	**% Change**
Buildings	9,849	9,869	0.2%
Vehicle Fleet	4,097	3,330	-19%
Streetlights	6,485	5,884	-9%
Water/Sewage	18,612	19,983	7%
Steam Plant	87,329	115,320	32%
Total	**126,370**	**154,386**	**22%**

Table 4. Comparison of 1996 and 2008 municipal operations GHG emissions for the City of Duluth, MN.

The most significant increase in emissions is from the Steam Plant. The increase is a result of both an increase in overall energy produced, but also an increase in the amount of energy generated from coal versus natural gas. Building emissions remained essentially the same, while fleet and streetlight emissions decreased.

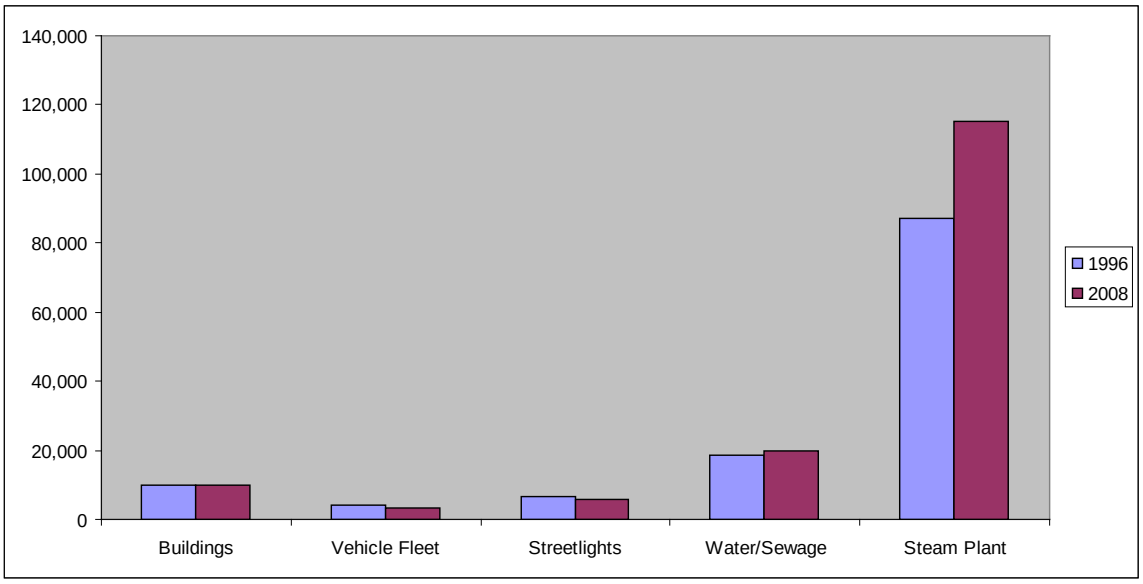


Figure 3, Greenhouse gas emissions for Duluth, MN.

Community Emissions

Total emissions from the community were also greater in 2008 than they were in 1999, with an increase of 16% overall. Changes occurred in all sectors, with industrial, transportation and waste showing the largest changes. The change in the transportation sector emissions is primarily a function of a likely error in the reported Vehicle Miles Travelled (VMT) in the 2001 report. Reduction in waste is also likely an artifact of a reporting discrepancy. Details of the VMT issue are described in Appendix B. Both 1999 and 2008 used the same waste breakdown percentages, and had similar total tons of waste entering the landfill. For the 2008 inventory, the landfill is defined as "actively managed", reflecting the gas collection system in place at the landfill. It is likely that the gas collection system was not taken into account in the 1999 inventory. Some of the change in the industrial sector can be attributed to the increase in emissions from the steam co-op, though not all. Specific changes by sector are shown in Table 5 and Figure 4.

	1999	*2008*	% change
Residential	568,337	536,963	-6%
Commercial	789,552	813,572	3%
Industrial	652,839	847,323	30%
Transportation	277,231	488,440	76%
Waste	34,905	15,839	-55%
Total	**2,322,834**	**2,702,137**	**16%**

Table 5. Community greenhouse gas emissions for the City of Duluth, MN for 1999 and 2008 in tons of CO2-equivalent.

One of the notable changes is the reduction in residential GHG emissions from 1999 to 2008. This is partially explained by the population decrease from 1999 to 2008. Per capita residential GHG emissions were 6.5 tCO2e/person in 1999 and 6.36 tCO2e/person in 2008, a drop of only 2%. The bulk of the reduction comes from reduced electricity consumption (Figure 5), with heating (natural gas plus fuel oil) remaining essentially the same.

The general distribution of emissions throughout the various sectors allows for emission reduction opportunities in a number of places. Although the City does not have direct control over most community GHG emissions, there are policy and grant-making activities that can address potential reduction opportunities. Because of the broad variety of sources of GHG emissions across sectors, policy changes and grant opportunities related to energy efficiency, energy conservation, transportation, renewable energy and waste reduction all have potential for contributing to GHG emission reductions.

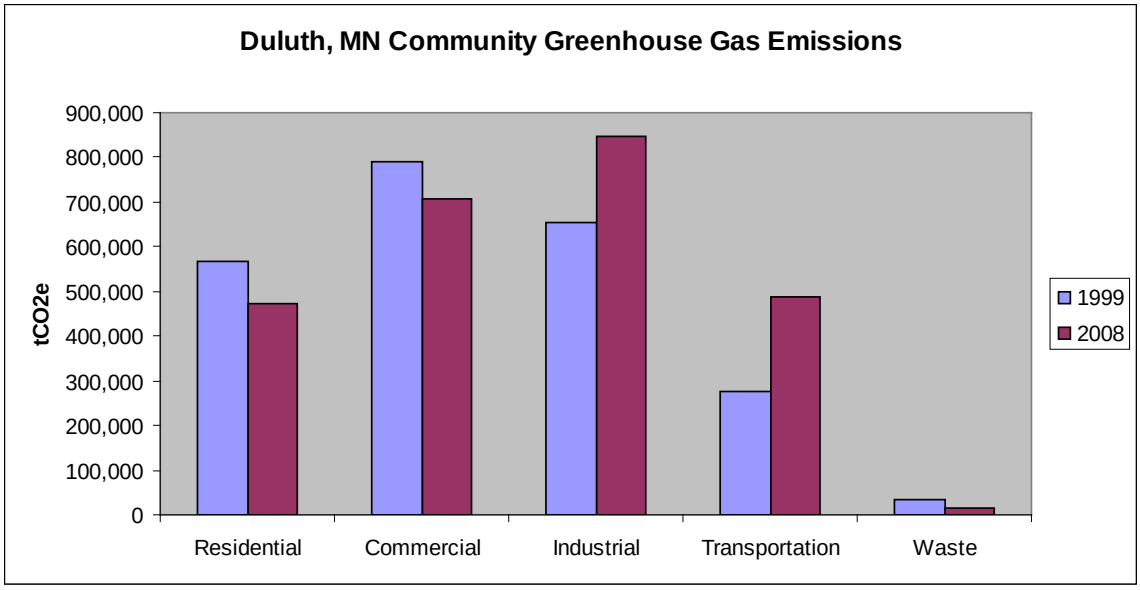


Figure 4. Community greenhouse gas emissions for the City of Duluth, MN for 1999 and 2008 in tons of CO2-equivalent.

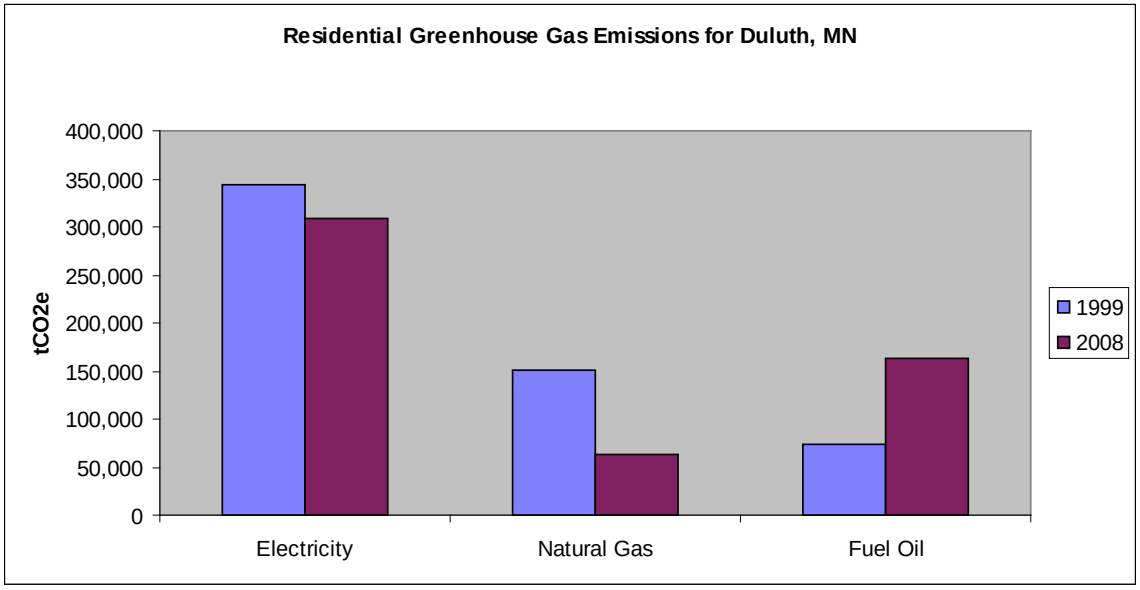


Figure 5. Residential greenhouse gas emissions for the City of Duluth, MN for 1999 and 2008 in tons of CO2-equivalent.

III. Next Steps

Compared with other municipalities nationwide, the City of Duluth took early action in measuring its GHG emissions. However, progression along the ICLEI milestone path was slowed over the past decade by budgetary and staffing constraints. EECBG program funding has allowed the re-ignition of the ICLEI process, and the hiring of an energy coordinator should allow for staff time to be dedicated to advancing the city along the milestone path. As outlined in the 2001 inventory report, the five milestones are:

1. Conduct a GHG Emissions Analysis
2. Set a Reduction Target
3. Develop a Local Action Plan
4. Implementing the Local Action Plan
5. Monitor Progress and Report Results

Duluth has now completed milestone 1 for a second time, and has begun work on steps two and three. The CCP Advisory Committee, along with city staff, have already begun the process of setting GHG emissions reduction targets and developing a local action plan, the next two steps in the ICLEI milestone process. The local action plan will detail strategies to meet reduction targets, and will identify specific opportunities for emission reduction through energy efficiency, energy conservation, waste reduction and renewable energy projects.

In a similar statewide effort, Minnesota set goals in the Next Generation Energy Act of 2007 to reduce statewide GHG emissions reductions as compared to 2005 levels as listed below:

- 15% by 2015,
- 30% by 2025, and
- 80% by 2050.

Local action plans and resulting projects can help the City of Duluth meet city and State goals. An illustration of the impact that local initiatives and planning could have on future emissions is provided in Appendix C. Using the MN RPS as an example, a switch in 20% of the fuel sources used to generate electricity could mean the difference between emissions increasing by 10% in 2020 or being reduced by 3% in 2020. While this initiative will not meet current targets by itself, it offers a significant start. The City of Duluth will need additional projects and initiatives to meet future goals.

As part of its ICLEI membership, the City has access to numerous ICLEI resources, including the Climate and Air Pollution Planning Assistant (CAPPA), a tool to prioritize emission reduction projects and develop a climate action plan. In addition, ICLEI has a comprehensive link to existing climate action plans and broader sustainability plans. Finally, ICLEI member organizations have gone through various stages of the ICLEI

milestone process, and tend to be willing and excited to share best practices and potential pitfalls to avoid.

The City of Duluth is well-positioned to begin actively managing its GHG emissions and energy consumption. Through careful planning and the leveraging of existing resources, the city has tremendous potential to reduce its GHG emissions through the most practical, cost-effective means possible.

Appendix A

Information Sources

Information sources

Quality activity data is key to developing a complete and accurate GHG inventory. Data is required from city staff, utility companies, regional planning agencies, state agencies and various local businesses and organizations. The following is a list of contacts for the various sources of data used in this report.

ICLEI-Local Governments for Sustainability USA
Brita Pagels, Regional Contact
21 S. Clark Street, 25th Floor
Chicago, IL 60603
Phone: (312) 377-6678
brita.pagels@iclei.org
http://www.icleiusa.org

Community Data Sources

Community Electricity Data
Name: Jim Peck, Manager Strategic Accounts
Organization: Minnesota Power
Phone: 218-355-3376
Email: japeck@mnpower.com

Community Natural Gas Data
Name: Eric Schlacks
Organization: Comfort Systems
Phone: (218) 348-9116
Email: eschlacks@duluthmn.gov

Community Fuel Oil/Diesel Data
Name: Michael Smith, Air Emission Inventory Coordinator
Organization: Minnesota Pollution Control Agency
Phone: (651) 757-2733
Email: Michael.Smith@state.mn.us

Community Coal Data
Name: Jerry Pelofske
Organization: Duluth Steam Co-op
Phone: (218) 723-3601

Community Road Transportation Data
Name: Jim Helig
Organization: Duluth Transit Authority
Phone: (218) 722-4426

Community Rail Transportation
Name: Dick Lambert, Office of Freight, Railroads and Waterways
Organization: Minnesota Department of Transportation
Phone: (651) 296-1609

Community Marine Transportation Data
Name: Jim Sharrow
Organization: Duluth Port Authority
Phone: (218) 727-8525
Email: jsharrow@duluthport.com

Population/economic forecasts
Name: Jim Skurla
Organization: University of Minnesota Duluth
Phone: (218) 726-7895
Email: jskurla@d.umn.edu

Waste Data
Name: Marianne Bohren
Organization: WLSSD
Phone: (218) 722-3336

Corporate Data Sources

Corporate Electricity Data
Name: DyAnn Andybur
Organization: City of Duluth
Phone: 218-730-4433
Email: dandybur@duluthmn.gov

Corporate Natural Gas Data
Name: Eric Schlacks
Organization: Comfort Systems
Phone: (218) 348-9116
Email: eschlacks@duluthmn.gov
:
Name: Jerry Pelofske
Organization: Duluth Steam Co-op
Phone: (218) 723-3601

Corporate Vehicle Fleet Data
Name: Arlen Bodenkircher
Organization: City of Duluth Fleet Services
Phone: (218) 730-4450
Email: abordenkircher@duluthmn.gov

Emission Factors

Emission Factors were included in the Clean Air Climate Protection (CACP) Software. These emission factors are also listed in the Local Government Operations Protocol (LGOP) Version 1.1, May 2010. Specific factors used are listed in the following tables.

Appendix A
Community GHG Emissions Factors

Residential

	lbs/gal	lbs/gal	lbs/gal
Fuel Oil (#1 2 4)	22.364	0.00336	0.00018
	lbs/mcf	lbs/mcf	lbs/mcf
Natural Gas	120.37	0.01134	0.00023
	lbs/MWh	lbs/MWh	lbs/MWh
Electricity	2,183.90	0.029	0.028

Industrial

	lbs/gal	lbs/gal	lbs/gal
Fuel Oil (#1 2 4)	22.364	0.00092	0.00018
Fuel Oil #5	22.510	0.0033	0.00022
Fuel Oil #6	24.846	0.0037	0.00022
	lbs/mcf	lbs/mcf	lbs/mcf
Natural Gas	120.37	0.0023	0.00023
	lbs/MWh	lbs/MWh	lbs/MWh
Electricity	2,183.90	0.029	0.028

Commercial

	lbs/gal	lbs/gal	lbs/gal
Fuel Oil (#1 2 4)	22.364	0.00336	0.00018
Fuel Oil #5	22.510	0.0033	0.00022
Fuel Oil #6	24.846	0.0037	0.00022
	lbs/ton	lbs/ton	lbs/ton
Commercial Coal	4,634.175	0.535	0.078
Sub-Bituminous	3,692.307	0.418	0.061
	lbs/mcf	lbs/mcf	lbs/mcf
Natural Gas	120.37	0.011	0.00023
	lbs/MWh	lbs/MWh	lbs/MWh
Electricity	2,183.90	0.029	0.028

Transportation

Marine - Commercial, Vista Fleet, Other	lbs/gal	g/mile	g/mile
OFF ROAD Diesel	22.377	0.740	0.260
OFF ROAD Residual Fuel Oil	26.015	0.860	0.300
OFF ROAD Gasoline	19.423	0.640	0.220
Rail	lbs/gal	g/mile	g/mile
OFF ROAD Diesel	22.377	0.800	0.260
Vehicles	lbs/gal	g/mile	g/mile
Diesel - Heavy Duty (alt. method)	22.364	0.0051	0.0048
Diesel - Light Duty (alt. method)	22.364	0.00099	0.00149
Diesel - Passenger (alt. method)	22.364	0.0005	0.001
Gasoline - Light Duty (alt. method)	19.412	0.03146	0.00431
Gasoline - Passenger (alt. method)	19.412	0.0278	0.0294

Appendix A
Community GHG Emissions Factors

Waste

Solid Waste - Managed Landfill	tons/ton	tons/ton	tons/ton
Paper	--	2.138	--
Food	--	1.21	--
Plant	--	0.686	--
Wood/Textiles	--	0.605	--

Notes:

mcf = thousand cubic feet

Conversion Factors

1 MWh = 1000 kWh

1 ton = 2000 pounds

1 pound = 453.6 grams

Appendix A
Government GHG Emissions Factors

Facilities

	lbs/gal	lbs/gal	lbs/gal
Fuel Oil (#1 2 4)	22.364	0.00336	0.00018
Fuel Oil #5	22.510	0.0033	0.00022
Fuel Oil #6	24.846	0.0037	0.00022
	lbs/ton	lbs/ton	lbs/ton
Commercial Coal	4634.175	0.535	0.078
Sub-Bituminous	3692.307	0.418	0.061
	lbs/mcf	lbs/mcf	lbs/mcf
Natural Gas	120.37	0.011	0.00023
	lbs/MWh	lbs/MWh	lbs/MWh
Electricity	2183.9	0.029	0.028

Transportation

Vehicles	lbs/gal	g/mile	g/mile
Diesel - Heavy Duty (alt. method)	22.364	0.0051	0.0048
Diesel - Light Duty (alt. method)	22.364	0.00099	0.00149
Diesel - Passenger (alt. method)	22.364	0.0005	0.001
Gasoline - Light Duty (alt. method)	19.412	0.03146	0.00431
Gasoline - Passenger (alt. method)	19.412	0.0278	0.0294

Notes:

mcf = thousand cubic feet

Conversion Factors

1 MWh = 1000 kWh

1 ton = 2000 pounds

1 pound = 453.6 grams

Appendix B

Assumptions and Calculations

Assumptions and calculations

Community inventory

The following describes the source data and any calculations that occurred prior to entering data into the CACP system.

Community Electricity Data

A GHG Emissions Factor was provided by Jim Peck from Minnesota Power. The emission factor is based on the average emission from power generation for Minnesota Power in the region for the year 2008. Billing records, including kWh and dollar costs were provided by Minnesota Power.

The customer class definitions remain the same as in the 2001 inventory:

Residential sector: A customer using electric energy supplied for residential (household) purposes.

Commercial sector: A customer using service at a location where the purchaser is engaged in selling, warehousing, or distributing a commodity, in some business activity, in rendering professional service, or in some form of social activity. In borderline cases where the nature of the customers' activities does not differentiate clearly between Commercial and Industrial, the service is classified as Commercial.

Industrial sector: A customer using service at a location where the purchaser is engaged in an industrial activity, such as the operation of factories, mills, machine shops, mines, oil wells, refineries, pumping plants, cleaning and dyeing works, creameries, canning establishments, stockyards, etc., that is, in extractive, fabricating or processing activities.

Input data for the above is:

	Electricity Use (kWh)	Bill Amount	Revenue	Taxes
Residential	282,300,994	$23,661,439.70	$22,121,782.09	$1,539,657.61
Commercial	536,762,820	$37,346,449.15	$35,600,652.05	$1,745,797.10
Industrial	579,500,919	$30,293,477.57	$30,160,182.13	$133,295.44

Community Natural Gas Data

Natural gas data was provided by Eric Schlacks of Comfort Systems. Natural gas consumption is broken into the same categories as electricity above. Data was given in thousand cubic feet (mcf), and was entered into CACP as such.

Input data for community natural gas is:

	Number of Customers	Volume (mcf)	Revenue (including taxes)
Residential	24,135	2,717,843	$34,513,008
Commercial	1,944	1,429,901	$16,891,195
Industrial	29	742,864	$8,005,735

Community Fuel Oil/Diesel Data

As described in the 2001 inventory, community-wide fuel oil data is not readily available. Rough estimates were attempted based on the methodology from the 2001 report.

Residential sector:

As with the 2001 report, residential fuel types were provided by the City Assessor's office. Average residential fuel use was assumed to be unchanged from 2001 at 787 gallons/residence. Total residential fuel oil customers were calculated as follows. Total residences listed as fuel oil (6622) were used as the base. An additional number fuel oil customers were calculated from the total residences recorded without a fuel type (1999) based on the fraction of fuel oil customers listed (6622/24437 = 27%). This fraction (542) was added to the 6622 listed to get total fuel oil customers of 7164. Total fuel oil consumption is therefore estimated at 7164 * 787 = 5,637,827 gallons of fuel oil.

Commercial/Industrial:

As with the 2001 report, commercial and industrial fuel types were calculated using data on file with the Minnesota Pollution Control Agency. While this is only a subset of all available fuel oil use, it does include the largest fuel oil users in the community. Fuel oil usage input is:

Community Coal Use Data

Coal use included in this report is exclusively from the steam coop. Coal use data was provided by Jerry Pelofske and staff from the Steam Coop. Coal use reported is: 150 tons of commercial coal; 60,191 tons of sub-bituminous coal.

Community Road Transportation Data

Emissions from road transportation were calculated based on vehicle miles travelled (VMT). Data for VMT for Duluth for 2008 was obtained from a MN DOT VMT report. VMT for 2008 is reported as 689.4 million miles. This is a significant increase over 1999 VMT from the 2001 report (391.3 million miles). After some investigation, it was determined that the 1999 VMT miles reported in 2001 were likely an underestimate, as MN DOT reports for 2001 (the most recently available) list VMT at 669 million. After discussion with MN DOT staff and City of Duluth Staff, there is not a viable explanation for an increase in nearly 300 million VMT between 1999 and 2001. It is therefore assumed that the 1999 number is in error.

Community Rail Transportation Data

The 2001 methodology and assumptions for community freight rail are used in calculating community rail emissions. Based on the estimates from 2001 from Dick Lambert, then of the Office of Freight, Railroads and Waterways at MN DOT, it is estimated that 90% of the cargo going through Duluth could be transported by train, and of that, 95% actually is. Based on total cargo measurements from the Duluth Port Authority of 45,640,002 tons, 15 miles of track and 204 ton-miles/gallon, fuel consumption is calculated as 2,869,280 gallons of diesel.

Community Marine Transportation Data

Jim Sharrow of the Port Authority estimated fuel consumption from vessels using the Duluth Harbor. The fuel consumption in ships is based on actual consumption figures for various vessels owned by U. S. operator American Steamship and represent total consumption from inbound the Duluth piers to outbound the piers. Ships that loaded in Superior but entered though the Duluth piers are included in the Duluth consumption numbers for the fuel consumed while maneuvering through the harbor- but not the fuel burned while loading. The split between maneuvering consumption and consumption while at the dock is estimated because the actual consumption numbers represented the combined total consumption. The number of ships that visited the Duluth-Superior harbor in 2008 was 1,126.

Fuel consumption (in gallons) was calculated as:

	All Fuels	#2 Diesel	Heavy Fuel
Duluth fuel consumption	409,800	237,800	172,000
Superior fuel consumption	522,700	369,100	153,600
Total harbor	932,500	606,900	325,600

In addition, the following estimates are included:

	#2 oil	Gasoline
Dredging operations (actual)	75,767 gal	
Tugboats	50,000 gal	
Pleasure craft	3,500 gal	77,500 gal
Charter boats	3,500 gal	
Pilot boats	3,600 gal	
Tour boats	28,800 gal	
Coast Guard		
Alder and other cutters	30,000 gal	
Patrol boats		22,500 gal
Corps of Engineers	9,000 gal	1,000 gal
Research vessels- EPA,UWS, UMD	10,000 gal	
Total- others	214,167 gal	101,000 gal

Community Waste Data

The waste breakdown from a 1999 waste sort study was used, as this is the most recent complete study available. Tonnage for 2008 was 61,150 tons, and the facility was classified as a "managed landfill". The waste breakdown was entered as follows:

- Construction and Demolition 1%	- Plastic 13%	- Yard Waste 3%
- Household Hazardous Waste 1%	- Wood 2%	- Metals 7%
- Textiles 3%	- Food Waste 14%	- Glass 3%
- Durables 1%	- Paper 39%	- Other 13%

Community Forecast Data

The recent economic downturn has made any economic predictions difficult. According to James Skurla, Director Bureau of Business and Economic Research at the University of Minnesota Duluth, any long-term growth predictions are highly dependent on the speed and magnitude at which we come out of the recession. However, a forecast for 2020 was calculated using energy consumption predictions from the Energy Information Administration's Annual Energy Outlook 2009 with Predictions to 2030 (2009). For the residential sector, electricity consumption is assumed to grow at 1% annually, natural gas at 0.4%. Fuel oil consumption is estimated to decline at 2.4% annually. For the commercial/industrial sectors, energy consumption is estimated to increase at 1% across all sources. Energy use for transportation is estimated at 0.5%.

Municipal Government Natural Gas, Electric and Fuel Oil

Electricity data was provided by DyAnn Andybur, City of Duluth Energy Coordinator. Electric data was based on utility bills from MN power. Bill segments were approximately monthly, and covered roughly a one year period, with some bill segments beginning late December 2007 and some bill segments ending in early January 2009, depending on billing cycles. Provided electric data was as follows:

RATE AND CLASS		COST	kWh	kW
TOTAL 2008 AREA LIGHTING	$	19,541.62	113,948	-
TOTAL 2008 GENERAL SERVICES	$	724,531.97	8,993,209	31,201
TOTAL 2008 LARGE LIGHT & POWER	$	890,543.86	15,573,602	30,691
TOTAL 2008 MUNICIPAL PUMP	$	402,427.48	5,986,589	15,391
TOTAL 2008 OVERHEAD STREET LIGHTS	$	344,138.76	2,243,350	437
TOTAL 2008 ORNAMENTAL STREET LIGHTS	$	37,073.06	556,571	1,273
TOTAL 2008 RESIDENTIAL ALL ELECTRIC	$	238.36	3,043	28
TOTAL 2008 ELECTRIC COST AND USE	$	2,418,495.11	33,470,312	79,021

Many of the accounts in the General Services category were indicated by intersections rather than specific addresses, and did not have a specific account name in the Tracker database. These intersections were assumed to be traffic signals or streetlights, and were entered into the CACP software as such.

Natural gas data was derived from the recently completed B3 survey, which assessed energy consumption at the major municipal buildings and pump stations. Natural gas consumption totaled 385,860 therms in 2008. An average price of $7.73 was assumed based on annual cost and consumption data provided by Eric Schlacks of Comfort Systems. Some limited fuel oil data was also included from the B3 analysis, though fuel oil use at city buildings is generally estimated to be very small.

Municipal Government Coal Data

Coal use included in this report is exclusively from the steam coop. Coal use data was provided by Jerry Pelofske and staff from the Steam Coop. Coal use reported is: 150 tons of commercial coal; 60,191 tons of sub-bituminous coal.

Municipal Government Fleet Data

Vehicle fuel consumption was provided by Arlen Bordenkircher from Fleet Services. Total gasoline consumption was calculated at 182,101 gallons and a cost of $528,276.88, and diesel at 136,241 gallons at a cost of $442,569.85. CNG and propane use in fleet vehicles is thought to account for very little if any overall fuel consumption.

Appendix C

Community Greenhouse Gas Forecast Results

Forecast Data and Renewable Portfolio Standards
2008 Duluth GHG Inventory

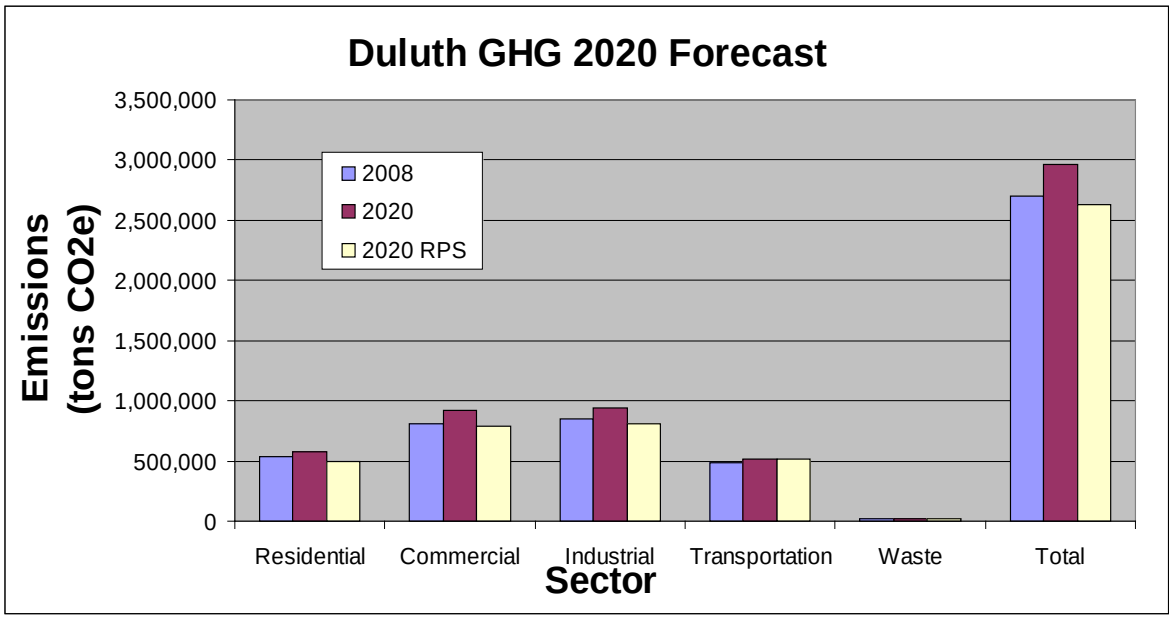
The time series report included on the previous page compares current emissions with those forecast accounting for growth factors. Changes in emission factors are not included in the time series report. The methodology is consistent with the 2001 report. However, local, state, regional, and nationwide efforts have increased tremendously since the baseline inventory. In the current environment, many entities have some form of commitment to address GHG emissions. Furthermore, entities have issued policies and regulations which address these emissions.

Specifically, the State of Minnesota has formally set goals to have 25% of its electric power generated from renewable sources by the year 2025. This goal will help reduce GHG emissions statewide. As such, Minnesota Power, Duluth's electric provider, has the same goal. While the goals are set by the state, no penalties have been set, and individual utilities must find their own renewable sources. For example, the sources could be woody biomass, wind, or solar. Woody biomass would still have CO_2, CH_4, and N_2O emissions. However, the CO_2 emissions are typically counted separately and do not count towards the emission factor. The CH_4 and N_2O typically do count towards the factor based on the nature of those emissions and the lifecycle. On the other hand, wind would not have any emissions. While differences could be negligible, the factors will depend on sources used to meet the goals.

Considering that the sources are unknown and the targets do not have penalties at this time, it is difficult to confidently forecast the effect of the portfolio standard on electric emission factors. The targets may not be met and emissions factors may not drop as proportionately to the portfolio. As a simple assumption, the current Minnesota power electric generation would have a prorated percentage of 20% of their energy sourced from a zero-CO_2 source in 2020. The CH_4 and N_2O percentage are held at 2008 levels. Using this assumption, the emission factor for CO_2 would be reduced by 20% to 1,746.4 lbs CO_2/MWh. The impact to the 2% growth forecast would be fairly significant. The overall 2020 community emissions would drop below the 2008 community levels. An updated time series accounting for the RPS is included below:

Duluth GHG Emissions Forecast
No RPS vs RPS

	2008	2020	2020 RPS	2020 %Change	2020 RPS %Change
Residential	536,963.2	572,689.8	498,654.2	7%	-7%
Commercial	813,572.5	916,753.8	784,445.5	13%	-4%
Industrial	847,322.8	936,812.5	811,941.6	11%	-4%
Transportation	488,823.7	516,459.0	516,459.0	6%	6%
Waste	15,838.6	20,087.2	20,087.2	27%	27%
Total	2,702,520.8	2,962,802.3	2,631,587.5	10%	-3%



Using the MN RPS as an example, a switch in 20% of the fuel sources used to generate electricity could mean the difference between emissions increasing by 10% in 2020 or being reduced by 3% in 2020. While this initiative will not meet current targets by itself, it offers a significant start. The City of Duluth will need additional projects and initiatives to meet future goals.

Duluth

Community Greenhouse Gas Emissions
Time Series Report

Year	2008	2020
Residential		
eCO2 (tons)	536,963.2	572,689.8
Commercial		
eCO2 (tons)	813,572.5	916,753.8
Industrial		
eCO2 (tons)	847,322.8	936,821.5
Transportation		
eCO2 (tons)	488,823.7	516,459.0
Waste		
eCO2 (tons)	15,838.6	20,087.2
Energy (MMBtu)	0.0	0.0
Total		
eCO2 (tons)	2,702,520.7	2,962,811.3

This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Appendix D

Community Greenhouse Gas Emission Results

Duluth

Community Greenhouse Gas Emissions in 2008

Summary Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Residential	534,873	9,555	57,975	536,963	19.9	4,541,974
Commercial	809,890	19,525	62,454	813,572	30.1	4,674,718
Industrial	843,671	19,168	64,806	847,323	31.4	4,823,465
Transportation	480,432	48,849	41,575	488,440	18.1	6,102,292
Waste	0	0	1,508,438	15,839	0.6	
Total	2,668,867	97,097	1,735,248	2,702,137	100.0	20,142,449

This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Duluth

Community Greenhouse Gas Emissions in 2008
Report by Source

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Commercial Coal	348	12	80	350	0.0	3,308
Diesel	72,447	428	440	72,518	2.7	898,470
Electricity	1,527,163	39,160	40,558	1,533,658	56.8	4,773,258
Food Waste	0	0	246,707	2,590	0.1	
Fuel Oil #5	33,747	661	9,916	33,954	1.3	419,783
Fuel Oil #6	143,556	2,548	43,309	144,405	5.3	1,733,340
Fuel Oil (#1 2 4)	63,606	1,043	19,113	63,969	2.4	788,825
Gasoline	367,607	48,408	41,099	375,542	13.9	4,704,956
Natural Gas	309,066	1,165	49,387	309,765	11.5	5,284,210
OFF ROAD Diesel	37,160	0	0	37,160	1.4	460,576
OFF ROAD Gasoline	981	0	0	981	0.0	12,547
OFF ROAD Residual Fuel Oil	2,237	0	0	2,237	0.1	25,744
Paper Products	0	0	1,214,151	12,749	0.5	
Plant Debris	0	0	29,957	315	0.0	
Sub-bituminous Coal	110,949	3,659	22,871	111,757	4.1	1,037,432
Wood or Textiles	0	0	17,622	185	0.0	
Total	2,668,867	97,084	1,735,212	2,702,135	100.0	20,142,449

Fuel costs include Buildings, Vehicle Fleet, Streetlights and Water/Sewage sectors only.
This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Community Greenhouse Gas Emissions in 2008
Report by Source

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Residential Sector						
Electricity	308,259	7,904	8,187	309,570	11.5	963,485
Fuel Oil (#1 2 4)	63,042	1,034	18,960	63,401	2.3	781,829
Natural Gas	163,573	617	30,828	163,992	6.1	2,796,660
Subtotal	534,873	9,555	57,975	536,963	19.9	4,541,974
Commercial Sector						
Commercial Coal	348	12	80	350	0.0	3,308
Electricity	586,118	15,029	15,566	588,611	21.8	1,831,955
Fuel Oil #5	22,514	441	6,615	22,652	0.8	280,056
Fuel Oil #6	2,753	49	831	2,769	0.1	33,240
Fuel Oil (#1 2 4)	489	8	147	492	0.0	6,068
Natural Gas	86,719	327	16,344	86,941	3.2	1,482,659
Sub-bituminous Coal	110,949	3,659	22,871	111,757	4.1	1,037,432
Subtotal	809,890	19,525	62,454	813,572	30.1	4,674,718
Industrial Sector						
Electricity	632,786	16,226	16,806	635,478	23.5	1,977,819
Fuel Oil #5	11,233	220	3,300	11,302	0.4	139,727
Fuel Oil #6	140,803	2,499	42,478	141,636	5.2	1,700,100
Fuel Oil (#1 2 4)	75	1	6	75	0.0	929
Natural Gas	58,775	222	2,215	58,832	2.2	1,004,891
Subtotal	843,671	19,168	64,806	847,323	31.4	4,823,465
Transportation Sector						
Diesel	72,447	428	440	72,518	2.7	898,470
Gasoline	367,607	48,408	41,099	375,542	13.9	4,704,956
OFF ROAD Diesel	37,160	0	0	37,160	1.4	460,576
OFF ROAD Gasoline	981	0	0	981	0.0	12,547
OFF ROAD Residual Fuel Oil	2,237	0	0	2,237	0.1	25,744
Subtotal	480,432	48,836	41,539	488,438	18.1	6,102,292

This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Community Greenhouse Gas Emissions in 2008
Report by Source

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Waste Sector						
Food Waste	0	0	246,707	2,590	0.1	
Paper Products	0	0	1,214,151	12,749	0.5	
Plant Debris	0	0	29,957	315	0.0	
Wood or Textiles	0	0	17,622	185	0.0	
Subtotal	0	0	1,508,438	15,839	0.6	
Total	2,668,867	97,084	1,735,212	2,702,135	100.0	20,142,449

This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Community Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Residential						
Duluth, MN						
Duluth Residential						
Electricity	308,259	7,904	8,187	309,570	11.5	963,485
Fuel Oil (#1 2 4)	63,042	1,034	18,960	63,401	2.3	781,829
Natural Gas	163,573	617	30,828	163,992	6.1	2,796,660
Subtotal Duluth Residential	534,873	9,555	57,975	536,963	19.9	4,541,974
Subtotal Residential	534,873	9,555	57,975	536,963	19.9	4,541,974
Commercial						
Duluth, MN						
College of St Scholastica						
Fuel Oil #6	2,128	38	642	2,140	0.1	25,690
Subtotal College of St Scholas	2,128	38	642	2,140	0.1	25,690
Duluth Commercial						
Electricity	586,118	15,029	15,566	588,611	21.8	1,831,955
Natural Gas	86,719	327	16,344	86,941	3.2	1,482,659
Subtotal Duluth Commercial	672,837	15,356	31,910	675,552	25.0	3,314,614
Duluth International Airport (DAA)						
Fuel Oil #6	5	0	1	5	0.0	60
Subtotal Duluth International A	5	0	1	5	0.0	60
Duluth Lake Port LLC						
Fuel Oil (#1 2 4)	34	1	10	34	0.0	416
Subtotal Duluth Lake Port LLC	34	1	10	34	0.0	416
Miller Hill Super One Foods						
Fuel Oil #6	2	0	1	2	0.0	30
Subtotal Miller Hill Super One	2	0	1	2	0.0	30

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Community Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Northland Constructors of Duluth LLC - Metallic						
Fuel Oil (#1 2 4)	140	2	42	141	0.0	1,733
Subtotal Northland Constructo	140	2	42	141	0.0	1,733
Qwest Communications - Duluth						
Fuel Oil (#1 2 4)	78	1	23	78	0.0	962
Subtotal Qwest Communicatio	78	1	23	78	0.0	962
St Mary's Medical Center						
Fuel Oil #6	567	10	171	571	0.0	6,850
Subtotal St Mary's Medical Ce	567	10	171	571	0.0	6,850
Steam Plant						
Commercial Coal	348	12	80	350	0.0	3,308
Fuel Oil (#1 2 4)	141	2	42	142	0.0	1,748
Sub-bituminous Coal	110,949	3,659	22,871	111,757	4.1	1,037,432
Fuel Oil #6	51	1	15	51	0.0	610
Subtotal Steam Plant	111,489	3,674	23,009	112,300	4.2	1,043,098
Tate & Lyle Ingredients Americas Inc						
Fuel Oil #5	22,514	441	6,615	22,652	0.8	280,056
Subtotal Tate & Lyle Ingredien	22,514	441	6,615	22,652	0.8	280,056
University of Minnesota - Duluth						
Fuel Oil (#1 2 4)	22	0	7	22	0.0	272
Subtotal University of Minneso	22	0	7	22	0.0	272
Western Lake Superior Sanitary District						
Fuel Oil (#1 2 4)	75	1	23	76	0.0	936
Subtotal Western Lake Superi	75	1	23	76	0.0	936
Subtotal Commercial	809,890	19,525	62,454	813,572	30.1	4,674,718

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Community Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Industrial						
Duluth, MN						
Bay Side Recycling Corp						
Fuel Oil (#1 2 4)	6	0	0	6	0.0	75
Subtotal Bay Side Recycling C	6	0	0	6	0.0	75
Duluth Paper Mill & Duluth Recycle Pulp						
Fuel Oil (#1 2 4)	2	0	0	2	0.0	31
Subtotal Duluth Paper Mill & D	2	0	0	2	0.0	31
General Mills Elevator A - Duluth						
Fuel Oil (#1 2 4)	2	0	0	2	0.0	30
Subtotal General Mills Elevato	2	0	0	2	0.0	30
Georgia-Pacific - Duluth Hardboard						
Fuel Oil #6	140,803	2,499	42,478	141,636	5.2	1,700,100
Subtotal Georgia-Pacific - Dulu	140,803	2,499	42,478	141,636	5.2	1,700,100
Industrial						
Electricity	632,786	16,226	16,806	635,478	23.5	1,977,819
Natural Gas	58,775	222	2,215	58,832	2.2	1,004,891
Subtotal Industrial	691,561	16,448	19,021	694,310	25.7	2,982,709
Northland Constructors of Duluth Gencor						
Fuel Oil (#1 2 4)	64	1	5	64	0.0	794
Fuel Oil #5	11,233	220	3,300	11,302	0.4	139,727
Subtotal Northland Constructo	11,297	221	3,306	11,366	0.4	140,521
Subtotal Industrial	843,671	19,168	64,806	847,323	31.4	4,823,465

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Community Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Transportation						
Duluth, MN						
Marine Transportation - Commercial						
OFF ROAD Diesel	2,661	0	0	2,661	0.1	32,977
OFF ROAD Residual Fuel	2,237	0	0	2,237	0.1	25,744
Subtotal Marine Transportatior	4,898	0	0	4,898	0.2	58,721
Marine Transportation - Other						
OFF ROAD Diesel	2,150	0	0	2,150	0.1	26,645
OFF ROAD Gasoline	981	0	0	981	0.0	12,547
Subtotal Marine Transportatior	3,131	0	0	3,131	0.1	39,192
Marine Transportation - Vista Fleet						
OFF ROAD Diesel	246	0	0	246	0.0	3,055
Subtotal Marine Transportatior	246	0	0	246	0.0	3,055
Rail						
OFF ROAD Diesel	32,103	0	0	32,103	1.2	397,899
Subtotal Rail	32,103	0	0	32,103	1.2	397,899
Vehicles						
Diesel	72,447	428	440	72,518	2.7	898,470
Gasoline	367,607	48,408	41,099	375,542	13.9	4,704,956
Subtotal Vehicles	440,054	48,836	41,539	448,060	16.6	5,603,426
Subtotal Transportation	480,432	48,836	41,539	488,438	18.1	6,102,292
Waste						
Duluth, MN						
Solid Waste Landfill						*Disposal Method - Managed Landfill*
Paper Products	0	0	1,214,151	12,749	0.5	
Food Waste	0	0	246,707	2,590	0.1	

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Community Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Plant Debris	0	0	29,957	315	0.0	
Wood or Textiles	0	0	17,622	185	0.0	
Subtotal Solid Waste Landfill	0	0	1,508,438	15,839	0.6	
Subtotal Waste	0	0	1,508,438	15,839	0.6	
Total	2,668,867	97,084	1,735,212	2,702,135	100.0	20,142,449

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Appendix E

Municipal Operations Greenhouse Gas Emission Results

Duluth

Government Greenhouse Gas Emissions in 2008

Summary Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	(%)	Energy (MMBtu)	Cost ($)
Buildings and Facilities	9,831	207	601	9,869	6	59,649	816,535
Steam Plant	114,496	3,749	23,125	115,320	75	1,054,804	910,296
Streetlights & Traffic Signals	5,859	150	156	5,884	4	18,313	610,702
Water/Sewage	19,898	508	550	19,983	13	63,620	1,086,400
Vehicle Fleet	3,291	236	214	3,330	2	41,515	970,847
Total	153,375	4,851	24,646	154,386	100	1,237,901	4,394,780

This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Duluth

Government Greenhouse Gas Emissions in 2008
Report by Source

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Commercial Coal	348	12	80	350	0.2	3,308	0
Diesel	1,523	9	7	1,525	1.0	18,893	442,570
Electricity	36,189	928	961	36,343	23.5	113,113	2,384,737
Fuel Oil #5	48	1	14	49	0.0	600	0
Fuel Oil #6	1	0	0	1	0.0	10	0
Fuel Oil (#1 2 4)	200	3	60	201	0.1	2,482	0
Gasoline	1,767	228	207	1,805	1.2	22,621	528,277
Natural Gas	2,257	9	425	2,263	1.5	38,586	298,245
Sub-bituminous Coal	111,041	3,662	22,890	111,849	72.4	1,038,287	740,951
Total	153,375	4,851	24,646	154,386	100.0	1,237,901	4,394,780

Fuel costs include Buildings, Vehicle Fleet, Streetlights and Water/Sewage sectors only.
This report has been generated for Duluth, MN using ICLEI's Clean Air and Climate Protection 2009 Software.

Government Greenhouse Gas Emissions in 2008
Report by Source

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings and Facilities Sector							
Commercial Coal	348	12	80	350	0.2	3,308	0
Electricity	10,545	270	280	10,590	6.9	32,959	698,383
Fuel Oil #5	48	1	14	49	0.0	600	0
Fuel Oil #6	1	0	0	1	0.0	10	0
Fuel Oil (#1 2 4)	169	3	51	170	0.1	2,094	0
Natural Gas	2,176	8	410	2,181	1.4	37,196	287,497
Sub-bituminous Coal	111,041	3,662	22,890	111,849	72.4	1,038,287	740,951
Subtotal	124,327	3,956	23,726	125,189	81.1	1,114,453	1,726,831
Streetlights & Traffic Signals Sector							
Electricity	5,859	150	156	5,884	3.8	18,313	610,702
Subtotal	5,859	150	156	5,884	3.8	18,313	610,702
Water Delivery Facilities Sector							
Electricity	19,188	492	510	19,269	12.5	59,973	1,042,443
Fuel Oil (#1 2 4)	31	1	9	31	0.0	388	0
Natural Gas	75	0	14	75	0.0	1,276	9,864
Subtotal	19,294	493	533	19,376	12.6	61,638	1,052,307
Wastewater Facilities Sector							
Electricity	598	15	16	600	0.4	1,868	33,209
Natural Gas	7	0	1	7	0.0	114	884
Subtotal	604	15	17	607	0.4	1,982	34,093
Vehicle Fleet Sector							
Diesel	1,523	9	7	1,525	1.0	18,893	442,570
Gasoline	1,767	228	207	1,805	1.2	22,621	528,277
Subtotal	3,291	236	214	3,330	2.2	41,515	970,847
Total	153,375	4,851	24,646	154,386	100.0	1,237,901	4,394,780

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Government Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings and Facilities							
Duluth, MN							
414 West 1st Street							
Electricity	291	7	8	292	0.2	908	17,810
Subtotal 414 West 1st Street	291	7	8	292	0.2	908	17,810
Aerial Bridge							
Electricity	276	7	7	277	0.2	863	18,982
Natural Gas	9	0	2	9	0.0	145	1,124
Subtotal Aerial Bridge	285	7	9	286	0.2	1,008	20,106
Animal Shelter							
Electricity	50	1	1	50	0.0	156	3,554
Natural Gas	36	0	7	36	0.0	611	4,724
Subtotal Animal Shelter	86	1	8	86	0.1	767	8,278
Bayfront Park Family Center							
Electricity	48	1	1	49	0.0	151	3,474
Natural Gas	9	0	2	9	0.0	153	1,184
Subtotal Bayfront Park Family	57	1	3	57	0.0	304	4,658
Bayfront Park Music House							
Electricity	81	2	2	81	0.1	253	6,108
Subtotal Bayfront Park Music I	81	2	2	81	0.1	253	6,108
Campground - 7214 Fremont Street							
Electricity	103	3	3	104	0.1	323	6,978
Subtotal Campground - 7214 F	103	3	3	104	0.1	323	6,978
Casino Parking Ramp							
Electricity	175	4	5	176	0.1	546	11,325
Subtotal Casino Parking Ramp	175	4	5	176	0.1	546	11,325

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Government Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Central Hillside Community Center							
Electricity	76	2	2	76	0.0	238	5,503
Natural Gas	64	0	12	65	0.0	1,103	8,523
Subtotal Central Hillside Comn	140	2	14	141	0.1	1,340	14,026
Chester Bowl Top Operator Shack							
Electricity	18	0	0	18	0.0	57	1,752
Subtotal Chester Bowl Top Op	18	0	0	18	0.0	57	1,752
Chester Bowl- Chalet							
Electricity	54	1	1	55	0.0	170	4,226
Natural Gas	14	0	3	14	0.0	242	1,868
Subtotal Chester Bowl- Chalet	69	1	4	69	0.0	412	6,094
Chester Bowl- Garage North							
Electricity	37	1	1	37	0.0	116	2,800
Subtotal Chester Bowl- Garage	37	1	1	37	0.0	116	2,800
Chester Bowl- Quanset Hut							
Electricity	11	0	0	11	0.0	34	1,026
Subtotal Chester Bowl- Quans	11	0	0	11	0.0	34	1,026
City Center West							
Electricity	314	8	8	315	0.2	982	21,935
Natural Gas	98	0	18	98	0.1	1,671	12,914
Subtotal City Center West	412	8	27	413	0.3	2,652	34,849
City Hall							
Electricity	64	2	2	64	0.0	200	44,761
Natural Gas	0	0	0	0	0.0	3	0
Subtotal City Hall	64	2	2	64	0.0	202	44,761

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Government Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Cobb Warming Shack							
Electricity	0	0	0	0	0.0	0	52
Subtotal Cobb Warming Shack	0	0	0	0	0.0	0	52
Coney Parking Ramp							
Electricity	22	1	1	22	0.0	68	1,690
Subtotal Coney Parking Ramp	22	1	1	22	0.0	68	1,690
Depot Parking Ramp							
Electricity	49	1	1	50	0.0	154	3,287
Subtotal Depot Parking Ramp	49	1	1	50	0.0	154	3,287
Duluth Art Institute							
Electricity	39	1	1	39	0.0	121	0
Natural Gas	45	0	9	46	0.0	777	6,002
Subtotal Duluth Art Institute	84	1	10	84	0.1	897	6,002
Duluth Heights Community Club							
Electricity	31	1	1	31	0.0	95	2,582
Natural Gas	30	0	6	30	0.0	505	3,900
Subtotal Duluth Heights Comm	60	1	6	60	0.0	600	6,482
Endion Depot							
Natural Gas	43	0	8	43	0.0	729	5,637
Subtotal Endion Depot	43	0	8	43	0.0	729	5,637
Enger Golf- Club House							
Electricity	73	2	2	73	0.0	227	0
Natural Gas	34	0	6	34	0.0	588	4,545
Subtotal Enger Golf- Club Hou	107	2	8	108	0.1	815	4,545
Enger Tower							
Electricity	6	0	0	6	0.0	20	521
Subtotal Enger Tower	6	0	0	6	0.0	20	521

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Government Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Facilities Management Building							
Electricity	143	4	4	143	0.1	446	9,639
Natural Gas	125	0	24	125	0.1	2,134	16,495
Subtotal Facilities Managemer	267	4	27	268	0.2	2,579	26,134
Fairmont Park Pavillion							
Electricity	32	1	1	32	0.0	100	0
Subtotal Fairmont Park Pavillic	32	1	1	32	0.0	100	0
Fire Hall #1							
Electricity	134	3	4	134	0.1	417	9,520
Natural Gas	15	0	3	15	0.0	259	2,005
Subtotal Fire Hall #1	149	3	6	149	0.1	677	11,525
Fire Hall #10							
Electricity	18	0	0	18	0.0	57	1,407
Natural Gas	73	0	14	74	0.0	1,255	9,703
Subtotal Fire Hall #10	92	1	14	92	0.1	1,312	11,110
Firehall #11							
Electricity	15	0	0	15	0.0	47	1,192
Natural Gas	23	0	4	23	0.0	387	2,994
Subtotal Firehall #11	38	0	5	38	0.0	435	4,186
Firehall #2							
Electricity	36	1	1	36	0.0	114	2,560
Natural Gas	50	0	9	50	0.0	852	6,582
Subtotal Firehall #2	86	1	10	86	0.1	965	9,142
Firehall #4							
Electricity	57	1	2	57	0.0	178	4,018
Natural Gas	40	0	8	40	0.0	687	5,311
Subtotal Firehall #4	97	2	9	98	0.1	865	9,329

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Government Greenhouse Gas Emissions in 2008
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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Firehall #5							
Electricity	10	0	0	10	0.0	30	767
Natural Gas	25	0	5	25	0.0	420	3,245
Subtotal Firehall #5	34	0	5	34	0.0	450	4,012
Firehall #6							
Electricity	38	1	1	38	0.0	118	2,608
Natural Gas	23	0	4	24	0.0	401	3,098
Subtotal Firehall #6	61	1	5	61	0.0	518	5,706
Firehall #7							
Electricity	53	1	1	53	0.0	165	3,622
Natural Gas	43	0	8	43	0.0	740	5,720
Subtotal Firehall #7	96	2	10	96	0.1	905	9,342
Fleet Services Building							
Electricity	168	4	4	168	0.1	524	12,720
Natural Gas	81	0	15	81	0.1	1,387	10,723
Subtotal Fleet Services Buildin	249	5	20	250	0.2	1,911	23,443
Fon-du-lac Community Club							
Electricity	6	0	0	6	0.0	19	729
Subtotal Fon-du-lac Communit	6	0	0	6	0.0	19	729
Gary Recreation Center							
Electricity	22	1	1	22	0.0	70	2,202
Natural Gas	13	0	3	13	0.0	228	1,764
Subtotal Gary Recreation Cen	36	1	3	36	0.0	298	3,966
Glen Avon- Hockey Building							
Electricity	44	1	1	44	0.0	138	4,221
Natural Gas	4	0	1	4	0.0	72	557
Subtotal Glen Avon- Hockey B	48	1	2	49	0.0	210	4,778

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Government Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Goodfellowship Community Club							
Electricity	91	2	2	91	0.1	285	7,201
Natural Gas	59	0	11	59	0.0	1,012	7,824
Subtotal Goodfellowship Comr	150	3	14	151	0.1	1,297	15,025
Grant Community Club							
Electricity	18	0	0	18	0.0	55	1,507
Natural Gas	20	0	4	20	0.0	346	2,677
Subtotal Grant Community Clu	38	1	4	38	0.0	402	4,184
Harrison Community Club							
Electricity	9	0	0	9	0.0	29	853
Natural Gas	15	0	3	15	0.0	259	2,000
Subtotal Harrison Community	24	0	3	25	0.0	288	2,853
Hillside Sport Court							
Electricity	2	0	0	2	0.0	7	531
Natural Gas	4	0	1	4	0.0	74	571
Subtotal Hillside Sport Court	6	0	1	6	0.0	80	1,102
Indian Point Campground							
Electricity	36	1	1	36	0.0	111	2,010
Subtotal Indian Point Campgro	36	1	1	36	0.0	111	2,010
Irving Community Club							
Electricity	31	1	1	31	0.0	98	3,273
Natural Gas	31	0	6	32	0.0	538	4,162
Subtotal Irving Community Clu	63	1	7	63	0.0	636	7,435
Lafayette Square							
Electricity	10	0	0	10	0.0	31	803
Natural Gas	20	0	4	20	0.0	334	2,581
Subtotal Lafayette Square	30	0	4	30	0.0	365	3,384

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Government Greenhouse Gas Emissions in 2008
Detailed Report

	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Lakeview Chalet (inclulding ski trails)							
Electricity	57	1	2	57	0.0	179	4,191
Subtotal Lakeview Chalet (incl	57	1	2	57	0.0	179	4,191
Lakewalk							
Electricity	121	3	3	122	0.1	379	8,469
Subtotal Lakewalk	121	3	3	122	0.1	379	8,469
Leif Erickson Park							
Electricity	38	1	1	39	0.0	120	2,905
Subtotal Leif Erickson Park	38	1	1	39	0.0	120	2,905
Lester Golf- Clubhouse							
Electricity	83	2	2	83	0.1	258	5,670
Fuel Oil (#1 2 4)	28	0	8	28	0.0	346	0
Subtotal Lester Golf- Clubhous	111	3	11	111	0.1	604	5,670
Lester Golf- Pump Building							
Electricity	18	0	0	18	0.0	55	2,174
Subtotal Lester Golf- Pump Bu	18	0	0	18	0.0	55	2,174
Lester Golf- Toolhouse							
Electricity	25	1	1	25	0.0	78	1,845
Subtotal Lester Golf- Toolhous	25	1	1	25	0.0	78	1,845
Lester Park Library							
Electricity	9	0	0	9	0.0	28	722
Natural Gas	17	0	3	17	0.0	288	2,226
Subtotal Lester Park Library	26	0	3	26	0.0	316	2,948
Lester Park- Comfort Station							
Electricity	4	0	0	5	0.0	14	0
Subtotal Lester Park- Comfort	4	0	0	5	0.0	14	0

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Government Greenhouse Gas Emissions in 2008
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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Lincoln Park Community Club							
Electricity	40	1	1	40	0.0	124	2,976
Subtotal Lincoln Park Commur	40	1	1	40	0.0	124	2,976
Lincoln Park- Pavillion							
Electricity	5	0	0	5	0.0	17	439
Natural Gas	11	0	2	11	0.0	180	1,394
Subtotal Lincoln Park- Pavillior	16	0	2	16	0.0	197	1,833
Longview Tennis Club							
Electricity	2	0	0	2	0.0	7	205
Subtotal Longview Tennis Clut	2	0	0	2	0.0	7	205
Lower Cester Community Club							
Electricity	19	0	1	19	0.0	60	1,688
Natural Gas	15	0	3	15	0.0	255	1,970
Subtotal Lower Cester Commu	34	1	3	34	0.0	315	3,658
Main Library							
Electricity	622	16	17	625	0.4	1,945	36,994
Subtotal Main Library	622	16	17	625	0.4	1,945	36,994
Memorial Community Club							
Electricity	23	1	1	24	0.0	73	1,991
Natural Gas	27	0	5	27	0.0	465	3,593
Subtotal Memorial Community	51	1	6	51	0.0	538	5,584
Merrit Community Club							
Electricity	9	0	0	9	0.0	29	1,197
Subtotal Merrit Community Clu	9	0	0	9	0.0	29	1,197
Miscellaneous Small Buildings							
Electricity	84	2	2	85	0.1	263	9,579
Subtotal Miscellaneous Small	84	2	2	85	0.1	263	9,579

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
MN Slip Pedestrian Bridge							
Electricity	40	1	1	40	0.0	125	2,840
Subtotal MN Slip Pedestrian B	40	1	1	40	0.0	125	2,840
Mount Royal Library							
Electricity	79	2	2	79	0.1	247	5,402
Subtotal Mount Royal Library	79	2	2	79	0.1	247	5,402
Norton Park Community Club							
Electricity	85	2	2	85	0.1	265	5,582
Natural Gas	14	0	3	14	0.0	234	1,805
Subtotal Norton Park Commun	98	2	5	99	0.1	498	7,387
Observation Community Club							
Electricity	27	1	1	27	0.0	85	0
Natural Gas	7	0	1	7	0.0	120	929
Subtotal Observation Commur	34	1	2	34	0.0	205	929
Park Point- Beach House							
Electricity	20	1	1	20	0.0	61	1,841
Subtotal Park Point- Beach Ho	20	1	1	20	0.0	61	1,841
Parking Lot - 302 East 1st Street							
Electricity	505	13	13	508	0.3	1,580	33,188
Subtotal Parking Lot - 302 Eas	505	13	13	508	0.3	1,580	33,188
Parking Ramp - 14 East 1st Street							
Electricity	521	13	14	523	0.3	1,628	32,866
Subtotal Parking Ramp - 14 Ea	521	13	14	523	0.3	1,628	32,866
Parks Toolhouse							
Electricity	42	1	1	42	0.0	132	3,259
Natural Gas	71	0	13	72	0.0	1,220	9,427
Subtotal Parks Toolhouse	113	1	15	114	0.1	1,351	12,686

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Piedmont Community Club							
Electricity	28	1	1	28	0.0	88	2,759
Natural Gas	11	0	2	11	0.0	192	1,487
Subtotal Piedmont Community	40	1	3	40	0.0	281	4,246
Police Garage							
Electricity	50	1	1	50	0.0	155	3,234
Subtotal Police Garage	50	1	1	50	0.0	155	3,234
Portman Community Club							
Electricity	36	1	1	36	0.0	112	3,366
Natural Gas	28	0	5	29	0.0	487	3,765
Subtotal Portman Community	64	1	6	65	0.0	599	7,131
Riverside Community Club							
Electricity	4	0	0	4	0.0	13	375
Natural Gas	14	0	3	14	0.0	240	1,852
Subtotal Riverside Community	18	0	3	18	0.0	253	2,227
Steam Plant							
Electricity	2,793	72	74	2,805	1.8	8,730	152,950
Commercial Coal	348	12	80	350	0.2	3,308	0
Fuel Oil (#1 2 4)	141	2	42	142	0.1	1,748	0
Natural Gas	124	0	23	124	0.1	2,121	16,395
Sub-bituminous Coal	111,041	3,662	22,890	111,849	72.4	1,038,287	740,951
Fuel Oil #5	48	1	14	49	0.0	600	0
Fuel Oil #6	1	0	0	1	0.0	10	0
Subtotal Steam Plant	114,496	3,749	23,125	115,320	74.7	1,054,804	910,296
Sundew Pedestrian Bridge							
Electricity	123	3	3	124	0.1	386	8,065
Subtotal Sundew Pedestrian B	123	3	3	124	0.1	386	8,065

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Toolhouse- Lakeside							
Electricity	5	0	0	5	0.0	14	0
Natural Gas	8	0	1	8	0.0	135	1,040
Subtotal Toolhouse- Lakeside	12	0	2	13	0.0	149	1,040
Toolhouse- Lund							
Electricity	31	1	1	31	0.0	97	2,547
Natural Gas	60	0	11	60	0.0	1,027	7,939
Subtotal Toolhouse- Lund	91	1	12	92	0.1	1,125	10,486
Toolhouse- West Duluth							
Electricity	74	2	2	74	0.0	231	5,553
Natural Gas	110	0	21	110	0.1	1,882	14,543
Subtotal Toolhouse- West Dul	184	2	23	185	0.1	2,113	20,096
Toolhouse- West Duluth- New Garage							
Electricity	9	0	0	9	0.0	27	698
Subtotal Toolhouse- West Dul	9	0	0	9	0.0	27	698
Wade Stadium							
Electricity	200	5	5	201	0.1	625	18,083
Subtotal Wade Stadium	200	5	5	201	0.1	625	18,083
Washington Center							
Electricity	248	6	7	249	0.2	777	16,560
Subtotal Washington Center	248	6	7	249	0.2	777	16,560
Wheeler							
Electricity	101	3	3	101	0.1	315	13,613
Subtotal Wheeler	101	3	3	101	0.1	315	13,613
Wheeler- Fieldhouse (Community Center)							
Electricity	24	1	1	24	0.0	76	1,927

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Natural Gas	48	0	9	48	0.0	813	6,281
Subtotal Wheeler- Fieldhouse	72	1	10	72	0.0	889	8,208
Wheeler- Garage							
Electricity	1	0	0	1	0.0	4	135
Subtotal Wheeler- Garage	1	0	0	1	0.0	4	135
Woodland Community Club							
Electricity	77	2	2	78	0.1	241	6,159
Natural Gas	41	0	8	41	0.0	693	5,360
Subtotal Woodland Community	118	2	10	118	0.1	935	11,519
Woodland- Fryberger Arena							
Electricity	491	13	13	493	0.3	1,534	34,436
Natural Gas	90	0	17	91	0.1	1,544	11,932
Subtotal Woodland- Fryberger	581	13	30	583	0.4	3,077	46,368
Zoo- Administration Building							
Electricity	305	8	8	306	0.2	952	20,304
Natural Gas	129	0	24	130	0.1	2,210	17,084
Subtotal Zoo- Administration B	434	8	32	436	0.3	3,162	37,388
Zoo- Animal Care Center							
Electricity	86	2	2	87	0.1	269	5,715
Natural Gas	31	0	6	31	0.0	522	4,038
Subtotal Zoo- Animal Care Ce	117	2	8	117	0.1	792	9,753
Zoo- Austrailian Building							
Electricity	59	2	2	60	0.0	185	3,954
Natural Gas	20	0	4	20	0.0	341	2,633
Subtotal Zoo- Austrailian Build	79	2	5	80	0.1	526	6,587

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Zoo- Childrens (Primate Center)							
Electricity	28	1	1	29	0.0	89	2,179
Natural Gas	62	0	12	62	0.0	1,061	8,199
Subtotal Zoo- Childrens (Prima	91	1	12	91	0.1	1,150	10,378
Zoo- Polar Complex							
Electricity	501	13	13	503	0.3	1,566	0
Natural Gas	190	1	36	191	0.1	3,256	25,172
Subtotal Zoo- Polar Complex	691	14	49	694	0.4	4,822	25,172
Subtotal Buildings and Facilities	124,327	3,956	23,726	125,189	81.1	1,114,453	1,726,831
Streetlights & Traffic Signals							
Duluth, MN							
Area Lighting							
Electricity	124	3	3	125	0.1	389	19,542
Subtotal Area Lighting	124	3	3	125	0.1	389	19,542
Miscellaneous Intersections							
Electricity	317	8	8	319	0.2	992	30,476
Subtotal Miscellaneous Intersе	317	8	8	319	0.2	992	30,476
Ornamental Street Lights							
Electricity	608	16	16	610	0.4	1,900	37,073
Subtotal Ornamental Street Lig	608	16	16	610	0.4	1,900	37,073
Overhead Street Lights							
Electricity	2,450	63	65	2,460	1.6	7,656	344,139
Subtotal Overhead Street Ligh	2,450	63	65	2,460	1.6	7,656	344,139
Streetlights/Signals							
Electricity	2,360	61	63	2,370	1.5	7,377	179,473
Subtotal Streetlights/Signals	2,360	61	63	2,370	1.5	7,377	179,473
Subtotal Streetlights & Traffic Si	5,859	150	156	5,884	3.8	18,313	610,702

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Water Delivery Facilities							
Duluth, MN							
Arlington Pump Station							
Electricity	956	25	25	960	0.6	2,989	55,227
Natural Gas	0	0	0	0	0.0	0	0
Subtotal Arlington Pump Static	956	25	25	960	0.6	2,989	55,227
Bayview Station							
Electricity	230	6	6	231	0.1	719	18,452
Subtotal Bayview Station	230	6	6	231	0.1	719	18,452
Chseter Bowl Pumps 1 & 2							
Electricity	59	2	2	59	0.0	184	6,613
Subtotal Chseter Bowl Pumps	59	2	2	59	0.0	184	6,613
East Pump Station							
Electricity	1,675	43	44	1,682	1.1	5,234	93,916
Natural Gas	9	0	2	9	0.0	154	1,189
Subtotal East Pump Station	1,684	43	46	1,691	1.1	5,388	95,105
Highland Pump Station							
Electricity	396	10	11	398	0.3	1,237	23,358
Subtotal Highland Pump Static	396	10	11	398	0.3	1,237	23,358
Lakeview Pump Station							
Electricity	76	2	2	76	0.0	236	8,229
Natural Gas	3	0	1	3	0.0	57	440
Subtotal Lakeview Pump Stati	79	2	3	79	0.1	293	8,669
Lakewood Pump							
Electricity	11,950	306	317	12,000	7.8	37,349	591,202
Fuel Oil (#1 2 4)	31	1	9	31	0.0	388	0
Subtotal Lakewood Pump	11,981	307	327	12,032	7.8	37,738	591,202

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Middle System Station							
Electricity	1,686	43	45	1,694	1.1	5,271	96,177
Natural Gas	9	0	2	9	0.0	150	1,157
Subtotal Middle System Statio	1,695	43	46	1,702	1.1	5,421	97,334
Miscellaneous Pump Stations							
Electricity	581	15	15	583	0.4	1,815	47,601
Subtotal Miscellaneous Pump	581	15	15	583	0.4	1,815	47,601
New Proctor Station							
Electricity	223	6	6	224	0.1	697	14,514
Subtotal New Proctor Station	223	6	6	224	0.1	697	14,514
Orphanage Pump Station							
Electricity	83	2	2	84	0.1	260	6,278
Natural Gas	3	0	1	3	0.0	56	433
Subtotal Orphanage Pump Sta	86	2	3	87	0.1	316	6,711
Water and Gas- Distribution							
Electricity	638	16	17	641	0.4	1,995	42,202
Natural Gas	44	0	8	44	0.0	756	5,841
Subtotal Water and Gas- Distr	682	17	25	685	0.4	2,750	48,043
Water Treatment Building							
Electricity	4	0	0	4	0.0	13	0
Subtotal Water Treatment Buil	4	0	0	4	0.0	13	0
West Duluth Booster Station							
Electricity	631	16	17	634	0.4	1,974	38,674
Natural Gas	6	0	1	6	0.0	104	804
Subtotal West Duluth Booster	638	16	18	640	0.4	2,078	39,478
Subtotal Water Delivery Facilitie	19,294	493	533	19,376	12.6	61,638	1,052,307

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Wastewater Facilities							
Duluth, MN							
Sewer Lift Station #13							
Electricity	19	0	1	19	0.0	59	1,463
Subtotal Sewer Lift Station #13	19	0	1	19	0.0	59	1,463
Sewer Lift Station #14							
Electricity	4	0	0	4	0.0	13	0
Subtotal Sewer Lift Station #14	4	0	0	4	0.0	13	0
Sewer Lift Station #15							
Electricity	490	13	13	492	0.3	1,530	29,324
Natural Gas	7	0	1	7	0.0	114	884
Subtotal Sewer Lift Station #15	496	13	14	498	0.3	1,644	30,208
Sewer Lift Station #8							
Electricity	64	2	2	64	0.0	199	0
Subtotal Sewer Lift Station #8	64	2	2	64	0.0	199	0
Sewer Lift Stations (Multiple)							
Electricity	21	1	1	22	0.0	67	2,422
Subtotal Sewer Lift Stations (M	21	1	1	22	0.0	67	2,422
Subtotal Wastewater Facilities	604	15	17	607	0.4	1,982	34,093
Vehicle Fleet							
Duluth, MN							
Aerial Lift							
Gasoline	0	0	0	0	0.0	2	41
Subtotal Aerial Lift	0	0	0	0	0.0	2	41

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Business Development							
Gasoline	2	0	0	2	0.0	21	494
Subtotal Business Developme	2	0	0	2	0.0	21	494
City Assessor							
Gasoline	2	0	0	2	0.0	27	676
Subtotal City Assessor	2	0	0	2	0.0	27	676
Engineering - Traffic							
Diesel	26	0	0	26	0.0	328	8,043
Gasoline	46	6	5	47	0.0	586	14,621
Subtotal Engineering - Traffic	72	6	5	73	0.0	914	22,664
Engineering - Utility							
Gasoline	39	5	4	40	0.0	497	11,888
Subtotal Engineering - Utility	39	5	4	40	0.0	497	11,888
Facilities Management							
Diesel	6	0	0	6	0.0	72	1,814
Gasoline	50	6	6	51	0.0	642	14,990
Subtotal Facilities Managemer	56	6	6	57	0.0	714	16,804
Fire							
Diesel	112	1	1	112	0.1	1,389	33,862
Gasoline	76	10	9	78	0.1	979	22,707
Subtotal Fire	188	10	10	190	0.1	2,368	56,569
Fleet							
Diesel	12	0	0	12	0.0	151	3,730
Gasoline	10	1	1	10	0.0	129	3,204
Subtotal Fleet	22	1	1	22	0.0	280	6,935

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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Gas							
Gasoline	155	21	15	159	0.1	1,984	46,467
Subtotal Gas	155	21	15	159	0.1	1,984	46,467
Library							
Diesel	0	0	0	0	0.0	3	61
Gasoline	6	1	1	6	0.0	74	1,689
Subtotal Library	6	1	1	6	0.0	77	1,750
Maintenance Ops.							
Diesel	778	4	3	779	0.5	9,654	215,788
Gasoline	128	16	15	131	0.1	1,640	41,732
Subtotal Maintenance Ops.	907	21	18	910	0.6	11,294	257,520
Police							
Diesel	1	0	0	1	0.0	17	473
Gasoline	958	122	116	978	0.6	12,260	283,384
Subtotal Police	959	122	116	979	0.6	12,277	283,857
Pumping							
Gasoline	9	1	1	9	0.0	117	2,741
Subtotal Pumping	9	1	1	9	0.0	117	2,741
Rec & Senior Service							
Diesel	10	0	0	10	0.0	125	3,162
Gasoline	4	1	1	4	0.0	54	1,426
Subtotal Rec & Senior Service	14	1	1	14	0.0	179	4,587
Sales							
Gasoline	2	0	0	2	0.0	21	485
Subtotal Sales	2	0	0	2	0.0	21	485

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Government Greenhouse Gas Emissions in 2008
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	CO_2 (tons)	N_2O (lbs)	CH_4 (lbs)	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Service							
Gasoline	87	12	9	89	0.1	1,112	24,562
Subtotal Service	87	12	9	89	0.1	1,112	24,562
Sewer							
Diesel	150	1	1	150	0.1	1,861	45,891
Gasoline	26	4	3	27	0.0	335	8,389
Subtotal Sewer	176	4	3	177	0.1	2,197	54,280
Steam							
Gasoline	10	1	1	10	0.0	124	2,871
Subtotal Steam	10	1	1	10	0.0	124	2,871
Storm							
Diesel	64	0	0	64	0.0	798	20,069
Gasoline	22	3	2	22	0.0	281	6,678
Subtotal Storm	86	3	2	87	0.1	1,080	26,747
Utility Operations							
Diesel	362	2	2	362	0.2	4,486	109,458
Gasoline	120	14	16	123	0.1	1,540	35,903
Subtotal Utility Operations	482	16	19	485	0.3	6,027	145,361
Workforce Development							
Gasoline	5	1	1	5	0.0	68	239
Subtotal Workforce Developme	5	1	1	5	0.0	68	239
Zoo							
Diesel	1	0	0	1	0.0	9	219
Gasoline	10	1	1	10	0.0	128	3,090
Subtotal Zoo	11	1	1	11	0.0	136	3,309
Subtotal Vehicle Fleet	3,291	236	214	3,330	2.2	41,515	970,847
Total	153,375	4,851	24,646	154,386	100.0	1,237,901	4,394,780

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Addendum 1

“Errata” and Other Considerations for Inventory Updates 2008 Duluth GHG Inventory

Addendum 1
"Errata" and Other Considerations for Inventory Updates
2008 Duluth GHG Inventory

The 2008 Duluth GHG Inventory details emissions by following the initial 2001 baseline inventory report methodology. The current report relies on the established baseline inventory to compare changes in emissions. In order to maintain consistency with both the 2001 report and the ICLEI LGOP, Duluth personnel and Wenck Associates, Inc. identified sources included in the previous report along with new sources. While the emissions source groupings remained the same for the most part, contributions within a group, specifically the vehicle fleet, changed based on programs implemented by the City of Duluth. As such, some contributions to the vehicle fleet emissions were not captured in the 2008 inventory.

In 2008, the City of Duluth operated under the FAVR program in order to reduce vehicles in their fleet. Additionally, the City also allowed employees to use their personal vehicle for occasional business use under certain circumstances. Employees were reimbursed for the associated mileage. Because these miles historically (i.e. during the 1996 baseline year) had been driven in fleet vehicles, the emissions were captured in the baseline inventory. In order to maintain consistency with the baseline inventory, the emissions from those miles should still be counted. Though, they are now considered Scope 3 emissions rather than Scope 1 in accordance with the most recent LGOP.

As provided by the City of Duluth, the business miles driven under the FAVR program in 2008 totaled 177,464 miles. These account for approximately 98 tons of CO_2e emissions (see attached calculations). Business miles driven in personal vehicles and reimbursed but not included in the FAVR program were not available at the time of this inventory.

Considering that vehicle emissions account for 2% of the government emissions and that the FAVR miles accounted for only 98 tons CO2e, the overall impact is insignificant. Based on the lack of reimbursed mileage information and insignificant contribution of FAVR miles, the omission is addressed in this addendum. However, it is recommended that these miles and similar situations be addressed in the inventories going forward in order to produce the most consistent comparison for tracking progress against goals.

Addendum 1 - FAVR Vehicle Miles

Corporate Inventory Fuel Distribution

182,101	gal gasoline
136,241	gal diesel
318,342	gal total
57.2%	gasoline
42.8%	diesel

FAVR Miles Based on Fuel Distribution

177,464	FAVR miles
101,515	gasoline miles
75,949	diesel miles
98	tons CO2e

	1996	2008*	2008**	% change
Vehicle Fleet Emissions	4097	3330	3428	-16%

*emissions not accounting for FAVR or POV miles driven for work

**emissions including miles driven under FAVR, POV miles driven for work not included