City Of Burnsville

Findings Report

Update for 2022 and 2023 to the City-Operations Greenhouse Gas Assessment for the City of Burnsville

Prepared for the City by

ORANGE ENVIRONMENTAL

August 2024

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Cover image from the City of Burnsville website

Table of Contents

Figures and Attachments

Page

Executive Summary

Introduction: In March 2011, CR Planning, Inc. and ORANGE Environmental, LLC prepared a greenhouse gas (GHG) assessment[1] for the City of Burnsville (City). This original GHG assessment set 2005 as the *Base Year* and included 2009 as an additional *Study Year*. It was composed of 3 major parts: A communitywide assessment, a city-operations assessment (both included in an Excel spreadsheet file), and a Findings Report that summarized the results. Under separate subsequent contracts with the City, ORANGE Environmental, LLC added data for study years 2011, 2013, 2015, 2017, 2019, and 2021 for the City Operations Assessment portion of the original report.

The information contained in this Findings Report adds the 2022 and 2023 study years to the City Operations Assessment (Assessment), also completed under separate contract by ORANGE Environmental, LLC. This most recent update replaces the prior reports and only includes data related to City operations, not communitywide information.

The Assessment methodology is consistent with the *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories*, produced by ICLEI— Local Governments for Sustainability (ICLEI Protocol) and The Climate Registry.

Terms: Since their start in the United States, GHG assessment have used a blend of metric and American measurement methods. The following terms are used throughout the Assessment:

- **Greenhouse gases:** Consistent with the ICLEI Protocol, GHGs are expressed in metric tons (tonnes), which equal 1,000 kilograms, or 2,204.6 pounds.
- **Energy:** Energy is expressed in British thermal units (Btu) as either kBtus (1,000 Btus) or MMBtus (1 million Btus). A Btu is the amount of heat energy needed to raise the temperature of 1 pound of water by 1 degree Fahrenheit.
- **Electricity:** Electricity is measured in watt-hours as either kWh (1,000 watt-hours) or MWh (1 million watt-hours).
- **Natural gas:** The Assessment uses the unit *therms* as the natural gas unit of measurement. A therm is equal to 100,000 Btus.
- **Sectors:** The ICLEI Protocol designates categories called sectors, which are the sources of GHG emissions: This Assessment uses the following sectors: buildings and facilities, streetlights and signals, potable water, sanitary sewers, transportation (which includes Public Works and fleets, contracted services, and official travel), solid waste management, and sanitary sewer treatment.
- **Assessment Scopes:** The ICLEI Protocol categorizes GHG emission sources into 3 groups called *scopes* as follows:
  - **Scope 1:** All direct GHG emissions from City operations. In addition to sources normally categorized as Scope 1, such as consumption of liquid fuels in City vehicles and natural gas consumption in City buildings, the City decided to also include contractor services and official travel because the City has considerable control over these emission sources.
  - **Scope 2**: Indirect GHG emissions associated with the consumption of purchased electricity from the 3 utilities that provide power.

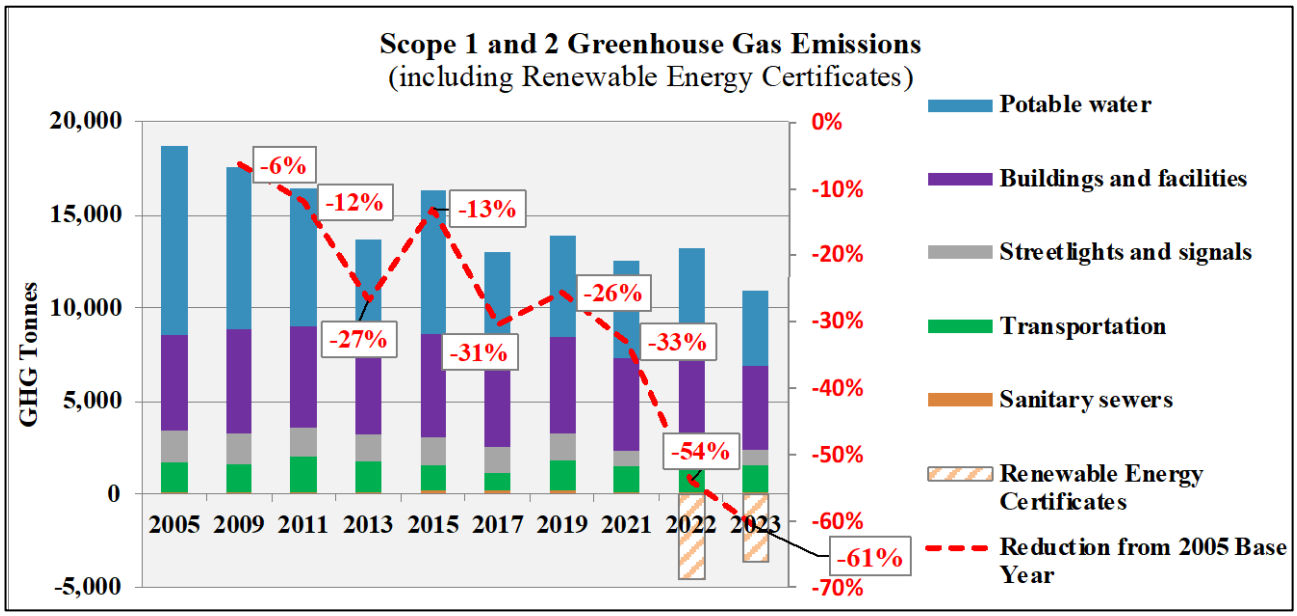
[1] Greenhouse gas assessments are often called *carbon baseline* assessments or greenhouse gas *inventories*. The terms are generally interchangeable. For clarity and simplicity, the term *greenhouse gas assessment* will be used herein. In addition, this Assessment includes the non-carbon-based greenhouse gas, nitrous oxide.

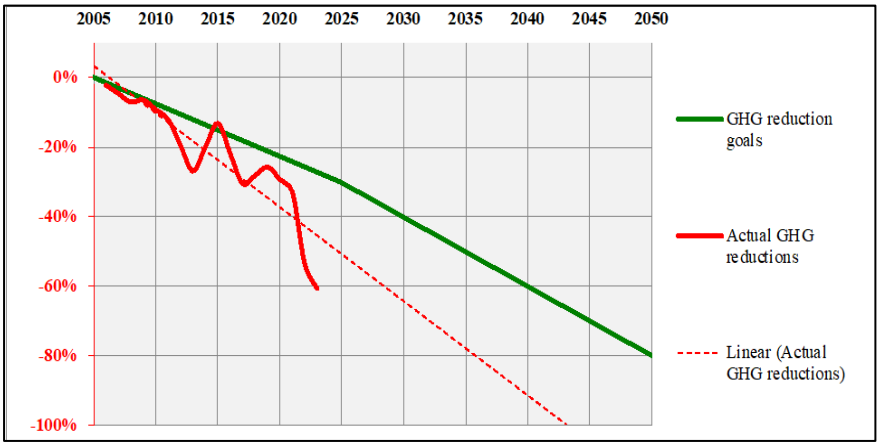
  - **Scope 3:** All other indirect emissions not covered in Scope 2; namely, emissions from the management of solid waste generated by City employees and from the treatment of the wastewater generated within the City. The ICLEI protocol requires that Scope 3 emissions are not counted with Scope 1 and 2 emissions. They must remain separate.
- **Renewable Energy Certificates:** Renewable Energy Certificates (RECs) are issued for each megawatt-hour of renewable electricity added to the grid. They serve as an accounting tool for renewable energy in the mixed-source power grid. The City purchased RECs in 2022 and 2023. RECs are not considered a sector but they function like negative GHG emissions for those 2 study years.
- **Community solar gardens:** Since 2017, the City has entered into 25-year lease agreements with 3 companies for community solar garden (CSG) energy. Since the City does not own the solar gardens, nor retain the RECs, the power purchased does not reduce the GHG emissions for the City in terms of this Assessment.

Emissions and change since 2005: The following table and line chart provide the total emissions by sector for each of the 10 study years over the 19-year Study Period and the percent change. All sectors had reduced emissions. It's important to note that the City's purchase of electricity from community solar gardens and RECs means that virtually all of the electricity consumed by City facilities and operations in 2022 and 2023 was classified as renewable energy.[2]

City Operations Emissions (tonnes)	2005	2009	2011	2013	2015	2017	2019	2021	2022	2023	Change from 2005
Scope 1 and 2 Emissions											
Buildings and facilities	5,060	5,626	5,424	4,542	5,535	4,943	5,123	4,983	5,316	4,467	-12%
Streetlights and signals	1,757	1,621	1,515	1,416	1,473	1,359	1,503	797	1,008	797	-55%
Potable water	10,231	8,650	7,471	5,963	7,688	5,552	5,473	5,238	5,270	4,079	-60%
Sanitary sewers	132	117	149	152	200	174	188	143	142	123	-7%
Transportation	1,556	1,530	1,927	1,629	1,403	986	1,630	1,378	1,467	1,460	-6%
Subtotal GHG Emissions	**18,736**	**17,545**	**16,486**	**13,701**	**16,298**	**13,013**	**13,916**	**12,538**	**13,203**	**10,926**	**-42%**
Renewable Energy Certificates									(4,576)	(3,598)	
Total Scope 1 & 2 GHG Emissions	**18,736**	**17,545**	**16,486**	**13,701**	**16,298**	**13,013**	**13,916**	**12,538**	**8,627**	**7,327**	**-61%**
Reduction from 2005 Base Year		-6%	-12%	-27%	-13%	-31%	-26%	-33%	-54%	-61%	
Normalized for electricity emission factors (excluding RECs)	18,736	18,132	17,930	15,723	17,790	16,176	16,610	15,858	17,367	15,628	-17%
Per-household GHG (incl. RECs)	0.77	0.71	0.69	0.55	0.65	0.52	0.55	0.49	0.33	0.28	-63%
Scope 3 Emissions											
Solid waste management	107	97	98	88	77	83	89	106	94	101	-6%
Sanitary sewer treatment	5,962	4,228	3,818	3,279	3,054	2,971	2,992	2,770	2,025	1,897	-68%
Total Scope 3 GHG Emissions	**6,069**	**4,325**	**3,916**	**3,367**	**3,131**	**3,054**	**3,081**	**2,876**	**2,118**	**1,998**	**-67%**

[2] The non-renewable portion of the power supplied by Minnesota Valley Electric Coop equaled 0.4% of the total power consumed by City operations in 2023.

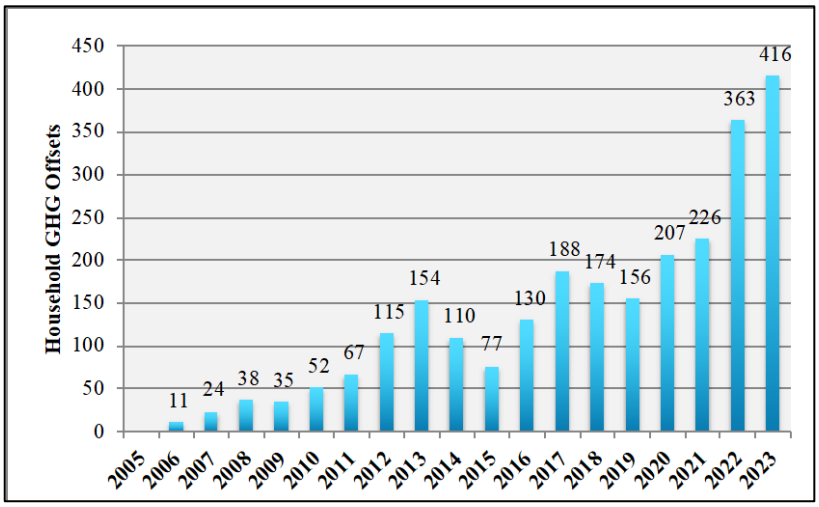


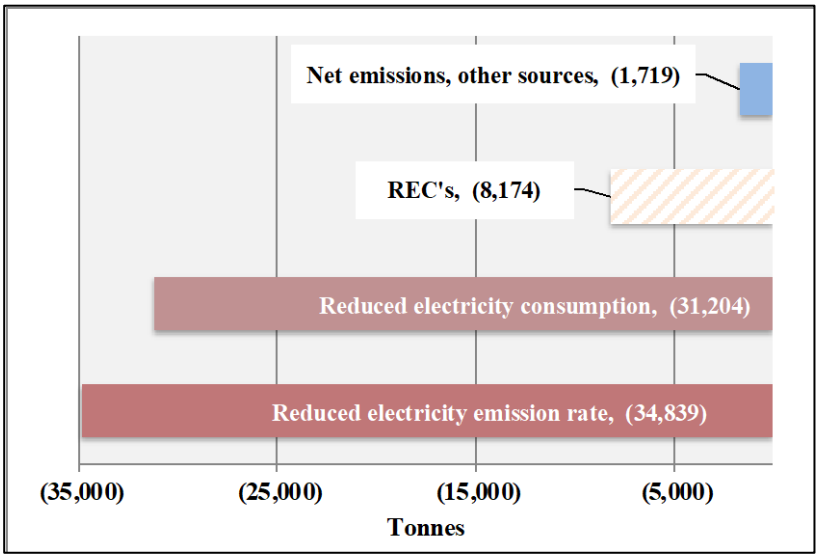


Reduction targets and accomplishments: In May 2010, the City began a process of identifying a GHG assessment protocol and criteria for setting reduction goals and strategy priorities. In 2011, the City prepared the report, *City of Burnsville GHG Reduction Goals, Implementation Priorities, Baseline Assessment*, which included the following goal: "Make continual progress over time toward the GHG reduction goals of Minnesota Next Generation Energy Act of 2007." The Act established nationally aggressive statewide greenhouse gas reduction goals, using 2005 as a baseline, of 15% by 2015, 30% by 2025, and 80% by 2050. The green line in the chart below graphs those goals.

In 2023, GHG emissions from city operations were -61% lower than in the 2005 Base Year. The green line in the upper chart on the right shows the City needing to hit the interim target of -60% reduction by 2040 in order to meet its ultimate goal of 80% reduction by 2050. This means the City already achieved that 2040 target-level of reduction a full 17 years ahead of schedule. The City accomplished these reductions even though it has considerably more space to illuminate, heat, and cool (e.g., the Ames Performing Arts Center and the Heart of the City parking ramp and the Parking Deck since 2009), it pumped 27% more water in 2023 than in the 2005 Base Year, and it had 12% more employees. The dotted red line in the chart is a linear projection to 2050 based on the actual reduction percentages from 2005 to 2023. If the City can continue this rate of GHG reduction, it will meet its -80% reduction goal around 2035, 15 years ahead of schedule.

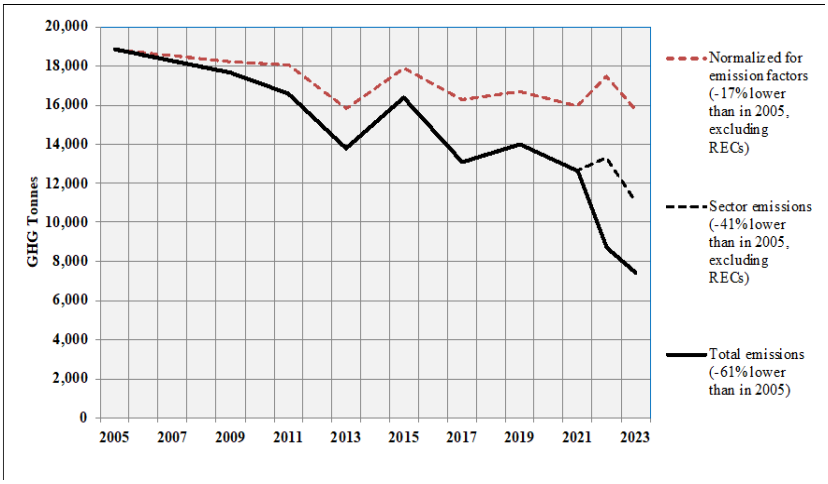
Over the 19-year Study Period, the City's annual GHG reductions below the 2005 Base Year's emissions totaled about 76,000 tonnes, almost 4,000 tonnes per year on average. This would offset the equivalent annual emissions from about 2,500 Burnsville households, or about 133 households on average each year (refer to above bar chart).





Causes of the change in emissions: The below chart illustrates the 4 primary factors that account for the estimated 76,000-tonne, net decrease in the GHG footprint from City operations over the 19-year Study Period:

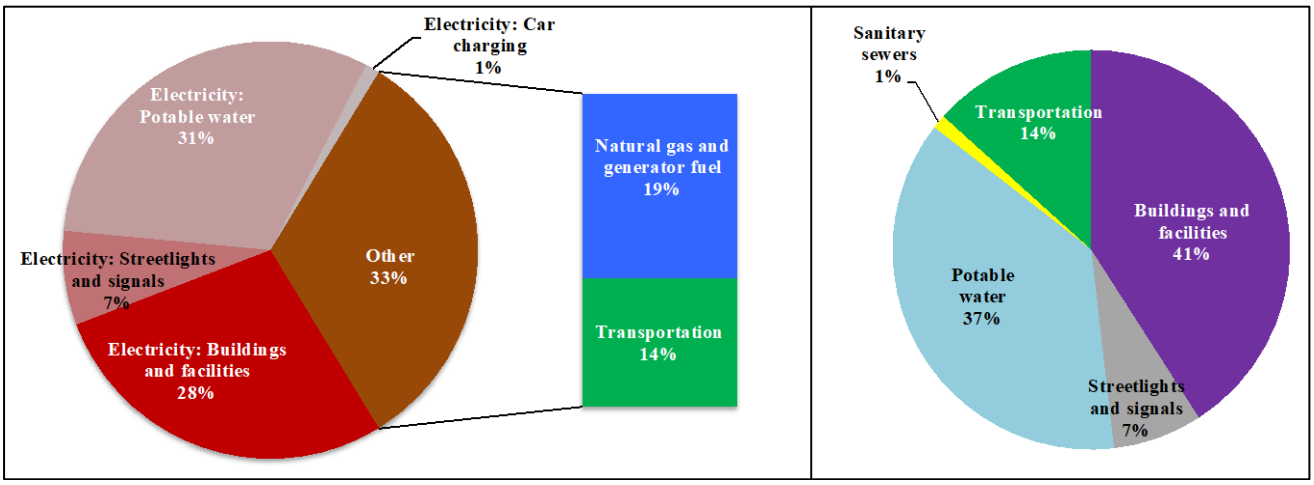
- **Electric utility emission factors:** Ever-declining, electric utility emission factors (GHG emissions per MWh) were the primary reason for the reduced emissions, nearly 35,000 tonnes since 2005. The blended emission factor from the 3 utilities that provide power was -38% lower in 2023 than in 2005 due to improved efficiency at the utilities, and less reliance on coal and more on natural gas and renewable fuels. Reduced utility emission factors are estimated to account for 46% of the reduced emissions over the 19-year Study Period.
- **Electricity consumption:** Electricity consumption is the largest source of GHG emissions (83% of the total since 2005, excluding RECs), and reduced electricity consumption is the second largest portion of GHG emission reductions, an estimated 31,200 fewer tonnes (47% of the total). The primary factors were equipment upgrades for the production of potable water and, to a much lesser extent, lighting upgrades to LED fixtures. Electricity consumption from potable water production in 2023 was -38% lower than in 2005. Electricity conservation is estimated to account for 41% of the reduced emissions over the 19-year Study Period.
- **Renewable Energy Certificates:** The City's purchase of nearly 9,000 MWh of RECs in 2022 and 2023 accounted for 12% of the reductions over the 19-year Study Period.
- **Other sources:** Other emission sources resulted in a net decrease of about 1,700 tonnes, which equaled 2% of the total decrease in emissions over the 19-year Study Period.

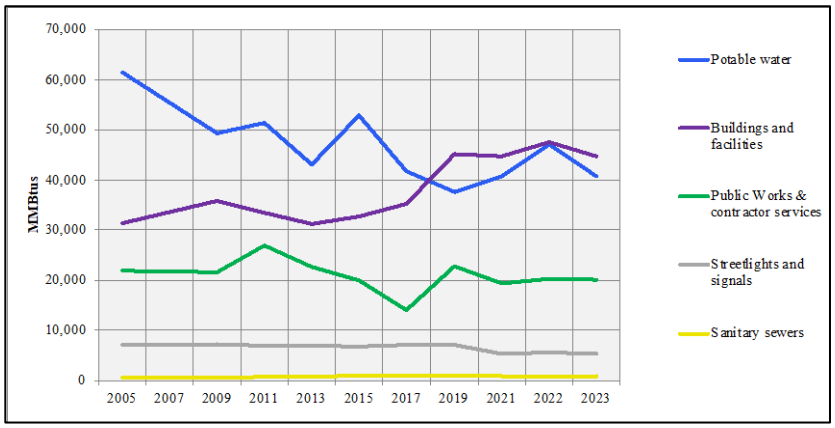


Normalizing emissions: To have a better *apples-to-apples* comparison over the 19-year Study Period, the data have been normalized (refer to the chart on the right). As mentioned above, the 3 electric utilities that produce the power used by the City have decreased their GHG emission rates (GHG per MWh) since 2005 such that the blended rate for the City's electricity consumption in 2023 was -38% lower than in the 2005 Base Year. The Assessment accounts for this by assuming the emission rates remained unchanged since 2005. Excluding RECs, the normalized emissions for facilities and emission factors in 2023 were -17% lower (the red dashed line in the chart above) compared to the actual -42% reduction (the dashed black line in the chart). The solid black line in chart shows the actual emissions total including the RECs.

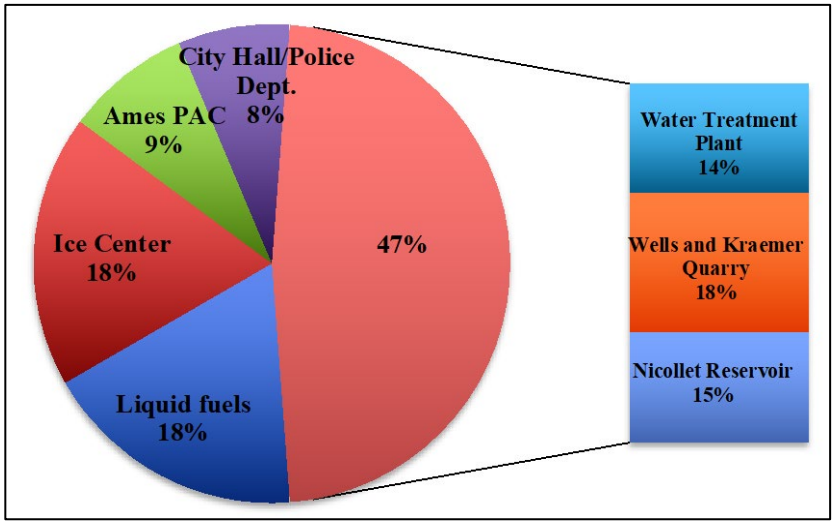
Sources of emissions in 2023: The 2 pie charts below allow easy comparisons of the 2023 data. The chart on the left breaks out the emission sources by fuel type and further defines electricity consumption, which resulted in 67% of the emission total, into its 3 major subcategories. The percentages broken out in the "Other" wedge of the chart include emissions from natural gas consumption and generator fuels and transportation, 19% and 14% respectively. The transportation sector includes the consumption of liquid fuels, emissions related to contractor services, and official travel.

The chart on the right breaks out emissions by sector in 2023. Since the first assessment in 2005, the production of potable water has dominated the story. In 2005, it accounted for 53% of total City emissions. Since then, the category has pumped significantly more water but at much greater energy efficiency. In 2023, it still accounted for 37% of total emissions from City operations, but buildings and facilities took over as the top emission category in 2023 with 41% of the total for the year. The transportation category is, again, shown with 14% of the total. The rest of the emissions were from streetlights and signals at 7%, and 1% from energy consumption for the sanitary sewer system.





Energy consumption: The chart to the right illustrates energy consumption by sectors throughout the Study Period. By charting energy instead of GHG emissions, it eliminates the effects of declining electric utility emission rates and RECs on the curves. The role of potable water and its sharp emission reductions (and increases in 2015 and 2021) cannot be understated. The chart shows the relatively flat lines of energy consumption for the other sectors over the 19-year Study Period, with the exception of the buildings and facilities category, which climbed significantly after 2013.

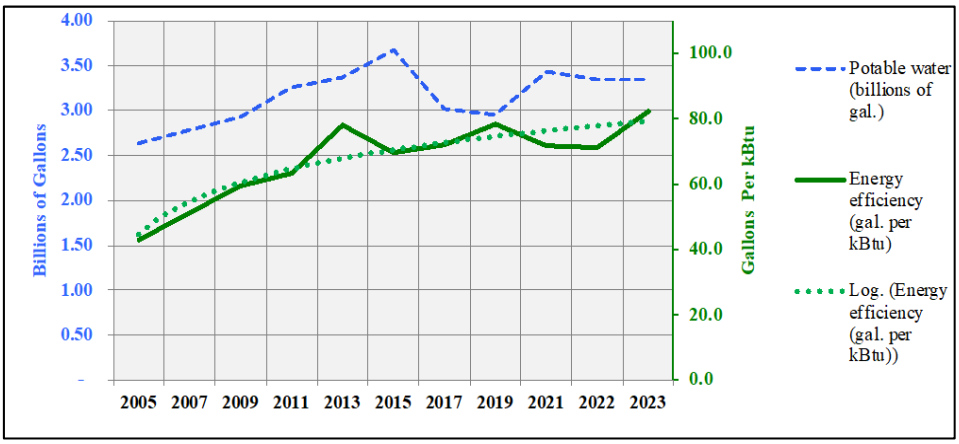


Seven largest sectors of emissions: Instead of examining the sectors, the pie chart to the right focuses on the emissions from just the 7 largest sources in 2023. It emphasizes the role of potable water production, which accounted for 47% of the emissions. The Ice Center was tied at 18% of the total with liquid fuels as the next largest sources. The Ames PAC and City Hall/Police Dept. were at 9% and 8% respectively.

Potable water: From 2005 through 2017, the system was the largest consumer of energy (predominantly electricity) and source of GHG emissions until the buildings and facilities category, which climbed significantly after 2013, surpassed the potable water sector in 2019 and in later study years. From 2007 to 2017, the City invested nearly $19 million in 28 major improvements to the

overall system, including the construction of a major addition to the Water Treatment Plant to treat surface water from the Kraemer Quarry, a major rehabilitation of the Water Treatment Plant, and 16 pump replacements. These improvements to the system resulted in most of the GHG reductions that enabled the City to exceed its GHG reduction goals.

Since 2005, GHG emissions associated with the production and distribution of potable water (including sales to other cities) decreased significantly. If *normalized* on the basis of tonnes-per-million-gallons, emissions were -69% lower in 2023 compared to 2005. Since Xcel Energy provides most of the electricity for the water system, the utility's very low emission factor, one of the lowest in the country, has helped significantly to reduce emissions. These lowered electricity emission factors accounted for approximately 14% of the system's reduction. Energy efficiency improvements to the system resulted in the other 86% of the GHG reductions. In 2023, at nearly 80 gallons per kBtu, it was 86% higher than in 2005. Put differently, the same amount of energy produced 86% more potable water in 2023 than in 2005 (refer to chart at right).



The Six Key Takeaways

1) Meeting City GHG reduction goals: In 2011, the City adopted Minnesota's aggressive statewide greenhouse gas (GHG) reduction goals, using 2005 as a baseline, of 15% by 2015, 30% by 2025, and 80% by 2050. With the exception of 2015, the City's GHG emissions for city operations have steadily declined since 2005 over the 19-year Study Period. Excluding Renewable Energy Certificates (RECs), emissions in 2023 were -42% lower than the 2005 Base Year, and thus already significantly exceeded the City's 2025 goal of 30% reduction. The City needs to hit the interim target of -60% reduction by 2040 in order to meet its ultimate goal of 80% reduction by 2050.

The City's purchase of 8,300 megawatt-hours of RECs in 2023 resulted in a total reduction of -61% that year compared to emissions in 2005. This means the City already achieved that 2040 target-level of reduction a full 17 years ahead of schedule.

Emission reductions over the 19-year Study Period would offset the equivalent annual emissions from about 2,500 Burnsville households, or about 133 households on average each year. The City's purchase of electricity from community solar gardens and RECs means that virtually all of the electricity consumed by City facilities and operations in 2022 and 2023 was classified as renewable energy.

2) Change factors: The key factors that accounted for the -61% reduction in emissions in 2023 compared to the 2005 Base Year are:

- **Reduced electricity emission rates and consumption:** The most important factor was that the blended electricity GHG emission rate in 2023 was -38% lower than the rate in 2005. That accounted for 46% of the reductions in 2023 compared to 2005. The second most important factor was the reduction in electricity consumption, which accounted for 41% of the reductions.
- **Renewable Energy Certificates and other reductions:** The City's purchase of RECs accounted for 11% of the reductions. Other factors accounted for the remaining 2% of the total reductions.

3) Electricity: Electricity consumption is the largest source of GHG emissions, 67% of the total in 2023. Electricity consumption (kWh) in 2023 was -53% lower than in the 2005 Base Year even though the City had considerably more space to illuminate, heat, and cool (e.g., the Ames Performing Arts Center, and the Heart of the City parking ramp and the Parking Deck since 2009), it pumped 27% more water in 2023 than in the 2005 Base Year, and there were 12% more employees.

4) Potable water system: The energy consumed to produce potable water has been the single most important driver of emission reductions. Importantly, consumption was high in the 2005 Base Year compared to subsequent years. The investment of nearly $19 million in 28 major improvements to the overall system, including the construction of a major addition to the Water Treatment Plant to treat surface water from the Kraemer Quarry, a major rehabilitation of the Water Treatment Plant, and 16 pump replacements, resulted in most of the GHG reductions that enabled the City to exceed its GHG reduction goals. As a result, the same amount of energy (Btus per gallon) produced 86% more water in 2023 than in 2005.

5) Natural gas: Natural gas consumption accounted for 19% of the emissions in 2023 (excluding RECs). Consumption (therms) was 39% higher in 2023 compared to the 2005 Base Year due primarily to increased consumption at the Ice Center, and consumption at the new Fire Station #1 and the Ames PAC, which were built after the 2005 Base Year. The overall increase in consumption would have been 16% larger still were it not for the significant decrease in consumption by the potable water system.

6) Transportation: Liquid fuel consumption (gal.) was -9% lower in 2023 compared to the 2005 Base Year. The GHG emissions for the transportation sector comprised 13% of the total in 2023, and they were -6% lower in 2023 than in 2005.

1. Background and Assessment Design

In March 2011, CR Planning, Inc. and ORANGE Environmental, LLC[3] prepared a greenhouse gas (GHG) assessment[4] for the City of Burnsville (City). This original GHG assessment set 2005 as the *Base Year* and included 2009 as an additional *Study Year*. It was composed of 3 major parts: A communitywide assessment, a city-operations assessment (both included in an Excel spreadsheet file), and a Findings Report (in Word) that summarized the results. Under separate subsequent contracts with the City, ORANGE Environmental, LLC added data for study years 2011, 2013, 2015, 2017, 2019, and 2021 for the City Operations Assessment portion of the original report.[5]

The information contained in this Findings Report adds the 2022 and 2023 study years to the City Operations Assessment (Assessment), also completed under separate contract by ORANGE Environmental, LLC. This most recent update replaces the prior reports and only includes data related to City operations, not communitywide information.

1.1. Benefits of Measurement:

As described by Osborne and Gaebler in their book, *Reinventing Government* (1992), "If you don't measure results, you can't tell success from failure. If you cannot see success, you cannot reward it. If you can't see failure, you can't correct it."

Every city prepares annual operating and capital improvement budgets. A city operations assessment is akin to the environmental budget for the city. GHG emissions offer a unique way to compare the effectiveness of various energy and sustainability choices and their related costs. GHG emissions serve as a common denominator for the comparison of kilowatts, natural gas therms, and gallons of vehicular fuels consumed; vehicle and air miles traveled; tons of municipal solid waste processed; gallons of sanitary sewage treated; and gallons of potable water produced.

This City Operations Assessment will:

- Enable the City to serve as a good example. A city can't legitimately ask its citizenry to increase energy efficiency and climate adaptability if it is unwilling to lead the way and track progress towards specific goals.
- Highlight opportunities to reduce emissions, and save resources and money. The City has limited ability to move the needle on communitywide emissions and adaptability but strong operational control over its own facilities.
- Provide baselines for estimating the effectiveness of many sustainability measures.
- Enable comparison with future inventories and peer cities.
- Inform subsequent analyses, plans, and policy decisions.

[3] Formerly called J. Michael Orange Environmental Consulting.
[4] Greenhouse gas assessments are often called *carbon baseline* assessments or greenhouse gas *inventories*. The terms are generally interchangeable. For clarity and simplicity, the term *greenhouse gas assessment* will be used herein. In addition, this assessment includes the non-carbon-based greenhouse gas, nitrous oxide.
[5] In the summer of 2015, the City joined the Regional Indicators Initiative and oversaw the preparation of 7 annual citywide GHG assessments for 2007 through 2021. This replaced the need for updates to the communitywide assessment.

- Improve the City's competitiveness for federal and state funding opportunities that are targeted to cities that have taken steps to measure and improve their energy efficiency and reduce their carbon footprints.
- Assist in promoting public understanding of the City's effects on climate change.
- Serve as a model for other cities.

Experience with prior assessments indicates that important benefits often result from the preparation process as well. It can spark common interest among the involved city staff in understanding why energy consumption fluctuates from year to year; it can identify meters that are no longer in use but still costing fees ("orphan meters"); it can encourage the sharing of ideas among different departments; and it can foster a common desire to reduce emissions.

1.2. Assessment Methodology: The Assessment methodology is consistent with the *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories*, produced by ICLEI— Local Governments for Sustainability (ICLEI Protocol), and The Climate Registry.[6] It includes all pertinent and available data for the 10 study years chosen by City staff (2005, 2009, 2011, 2013, 2015, 2017, 2019, 2021, 2022, and 2023).

Color Scheme for Charts	Color
Fuels:	
Electricity	
Electricity emission factor	
Natural gas	
RDF	
Energy and GHG:	
MMBtu	
GHG	
Emissions sources:	
Buildings	
Parks	
Streetlights	
Transportation	
Solid waste	
Potable water	
Wastewater	
Totals	
Renewable Energy Certificates	

The source information for the tables and charts included in the body of the report can be found in the spreadsheets that have been provided to the City as a technical supplement to this Assessment. The charts in the spreadsheets and this report generally conform to the adjacent color scheme to aid understanding. City staff are the source for data that pertains to City operations unless otherwise noted. All of the sources of data for the Assessment are transparent, fully identified, verifiable, and reliable. They consist of City records and staff reports; utility records and reports to the Minnesota Public Utilities Commission; internationally recognized methodologies and published scientific papers regarding the calculation of GHG emissions; federal, state, and county agencies (USDOT, USEPA, MNDOT, MPCA, Metropolitan Council, Metropolitan Airports Commission, Dakota County); and other published sources.

1.3. Assessment Scopes: The ICLEI Protocol categorizes GHG emission sources into 3 groups called *scopes* as follows:

- **Scope 1:** All direct GHG emissions from City operations. In addition to

[6] Source: https://s3.amazonaws.com/icleiusaresources/lgo_protocol_v1_1_2010-05-03.pdf

sources normally categorized as Scope 1, such as consumption of liquid fuels in City vehicles and natural gas consumption in City buildings, the City decided to also include contractor services and official travel because the City has considerable control over these emission sources.

- **Scope 2:** Indirect GHG emissions associated with the consumption of purchased electricity from the 3 utilities that provide power.

- **Scope 3:** All other indirect emissions not covered in Scope 2; namely, emissions from the management of solid waste generated by City employees and from the treatment of the wastewater generated within the City.[7] The ICLEI protocol requires that Scope 3 emissions are not counted with Scope 1 and 2 emissions. They must remain separate.

1.4. Assessment Organization: This GHG Assessment has 3 components: 1) An accompanying spreadsheet analysis includes 26 spreadsheets that calculate the GHG emissions and the other needed data, 2) this Findings Report describes the results of the spreadsheet analysis, and 3) an Executive Summary provides a concise synopsis suitable for the City's website. In general, topics in this Findings Report will be covered from the general to the specific beginning with Section 2, which provides a description of the overall results of the analysis, including GHG reduction goals. Section 3 examines the sources of emissions. The general approach is to first describe energy consumption by sector or source category, then identify the associated emissions and the key reasons for change. Attachment A includes the detailed summary table from the spreadsheet analysis that accompanies this Findings Report.

A key consideration is change over time, and 2 key factors affect the accuracy of comparing the current study year with the 2005 Base Year: Electricity consumption has a domineering effect on emissions and the electric utilities have consistently reduced the GHG impacts of the power they supply to the City. Thus, these declining electricity emissions factors must be *normalized* to develop a better *apples-to-apples* comparison. The demand for City services varies somewhat as the population has grown, so per-capita and per-household data are included. In addition, weather, especially winter weather, can affect energy consumption; however, the effect is very marginal, so this factor is not normalized quantitatively.

The Assessment includes ways to put the value of the City's reductions into perspective by considering them offsetting other emissions. It compares them to the emissions from the average Burnsville household and estimates the equivalent offsets.

[7] Sources included in some assessments but excluded in this one include emissions associated with employee commutes because the City has no operational control over employee commutes, and refrigerant leakages because they are expected to be *de minimus*, i.e., less than 5% of total emissions.

1.5. **Terms:** Since their start in the United States,[8] GHG assessment have used a blend of metric and American measurement methods. The following terms are used throughout the Assessment:

- **Greenhouse gases:** Consistent with the ICLEI Protocol, GHGs are expressed in metric tons (tonnes), which equal 1,000 kilograms, or 2,204.6 pounds.[9]
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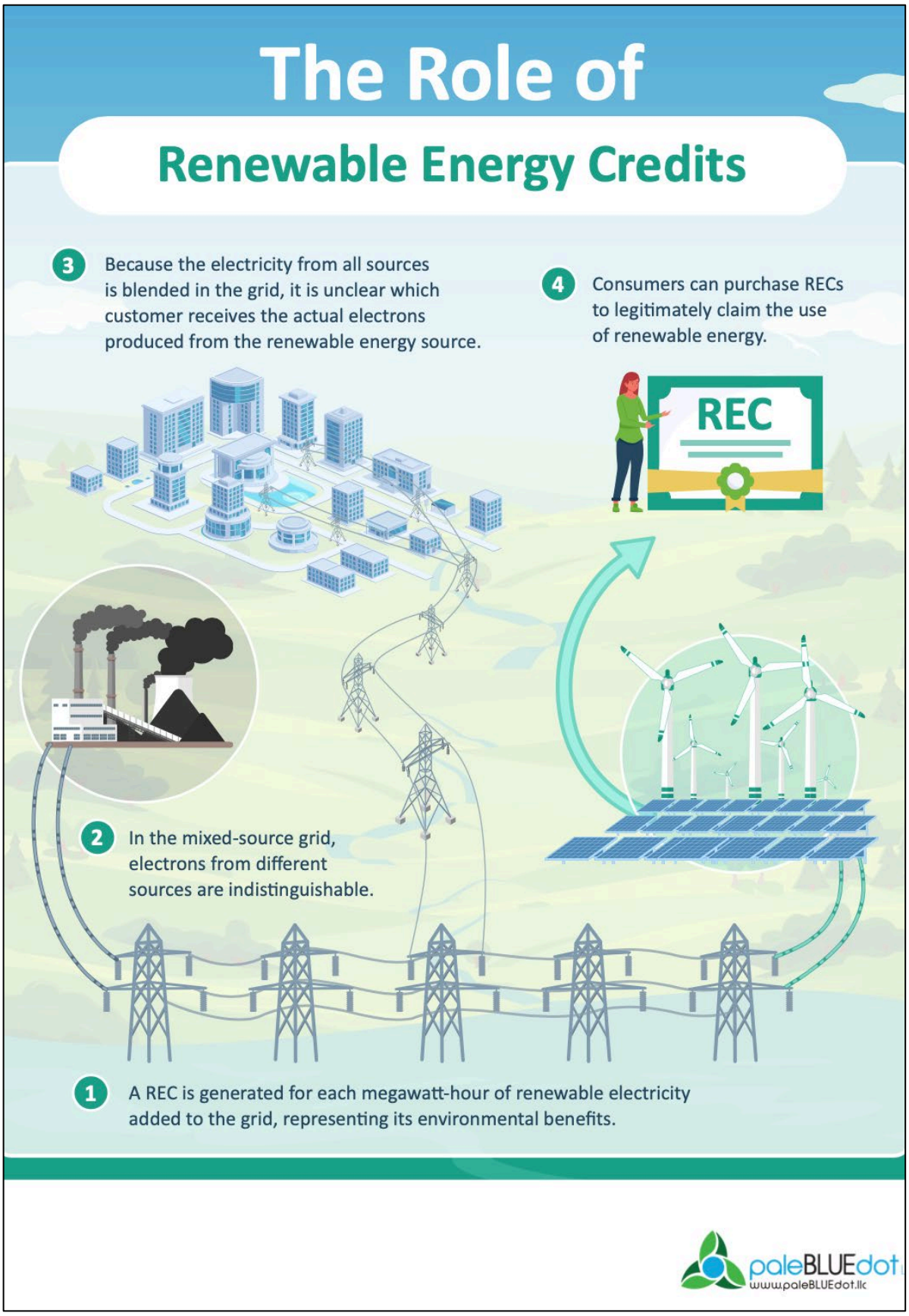
- **Natural gas:** The Assessment uses the unit *therms* as the natural gas unit of measurement. A therm is equal to 100,000 Btus.
- **Sectors:** The ICLEI Protocol designates categories called sectors, which are the sources of GHG emissions: This Assessment uses the following sectors: buildings, parks, potable water, lights and signals, sanitary sewers, transportation, solid waste management, and sanitary sewer treatment.
- **Renewable Energy Certificates:** Renewable Energy Certificates (RECs) are issued for each megawatt-hour of renewable electricity added to the grid. They serve as an accounting tool for renewable energy in the mixed-source power grid. RECs represent the environmental benefits of renewable energy, with only the final consumer of the REC having the right to claim these benefits. RECs are not considered a sector but they function like negative GHG emissions (refer to the infographic below).
- **Community solar gardens:** Since 2017, the City has entered into 25-year lease agreements with 3 companies for community solar garden (CSG) energy. Since the City does not own the solar gardens, nor retain the RECs, the power purchased does not reduce the GHG emissions for the City in terms of this Assessment.

[8] Soon after the creation of ICLEI, the organization's first major project was to develop the first international protocol for preparing citywide GHG assessments, and to manage the preparation of the first GHG assessments in 13 cities worldwide, including Minneapolis and St. Paul. In 1993, both cities adopted the "Minneapolis-St. Paul CO_2 Reduction Project" report.

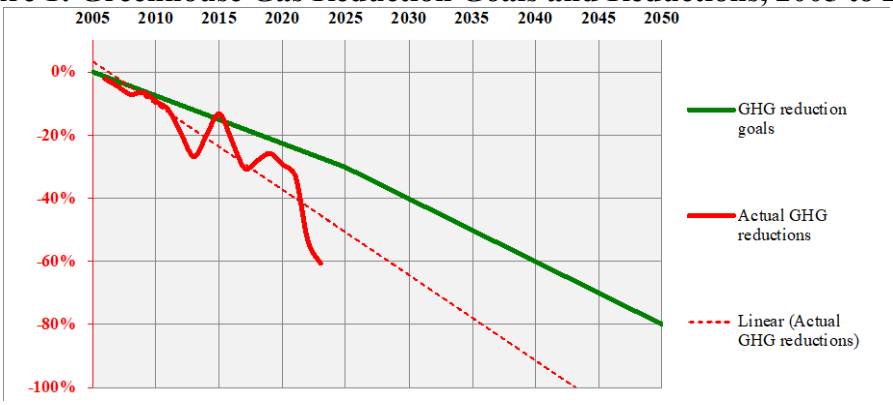
[9] The greenhouse gases of carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) are aggregated and reported as carbon dioxide equivalents, a commonly used unit that combines greenhouse gases of differing impact on the earth's climate into one weighted unit. The use of the term *greenhouse gasses* herein implies the carbon dioxide equivalents of these 3 key greenhouse gases. The source information for the tables and charts included in the body of the report can be found in the detailed tables that have been provided to the City as a technical supplement to this Assessment. City staff provided all data that pertains to City operations unless otherwise noted. Energy consumption data for City buildings and facilities are from the utilities and the Minnesota Buildings, Benchmarks, and Beyond (B3) Program when available.


The Role of
Renewable Energy Credits
3 Because the electricity from all sources is blended in the grid, it is unclear which customer receives the actual electrons produced from the renewable energy source.
4 Consumers can purchase RECs to legitimately claim the use of renewable energy.
REC
2 In the mixed-source grid, electrons from different sources are indistinguishable.
1 A REC is generated for each megawatt-hour of renewable electricity added to the grid, representing its environmental benefits.
paleBLUEdot
www.paleBLUEdot.llc

2. Greenhouse Gas Reduction Targets and Overall Results

2.1. Reduction Targets: In May 2010, the City began a process of identifying a GHG assessment protocol and identifying criteria for setting reduction goals and strategy priorities. In 2011, the City prepared the report, *City of Burnsville GHG Reduction Goals, Implementation Priorities, Baseline Assessment* (March, 2011), which included the following goal: "Make continual progress over time toward the GHG reduction goals of Minnesota Next Generation Energy Act of 2007." The Act established nationally aggressive statewide greenhouse gas reduction goals, using 2005 as a baseline, of 15% by 2015, 30% by 2025, and 80% by 2050.

Figure 1: Greenhouse Gas Reduction Goals and Reductions, 2005 to 2050



Sector emissions (excluding RECs) in 2023 were -42% lower than in 2005 and thus already significantly exceeded the City's 2025 goal of 30% reduction 2 years ahead of schedule. The City accomplished these reductions even though it has considerably more space to illuminate, heat, and cool (e.g., the Ames Performing Arts Center and the Heart of the City parking ramp and the Parking Deck since 2009), it pumped 27% more water in 2023 than in the 2005 Base Year, and it had 12% more employees.

Beginning 2022, the City began purchasing Renewable Energy Certificates (RECs) through the Dakota Electric Association (DEA). As mentioned in Section 1.5., each MWh of consumption that was produced by renewable energy (i.e., 1 REC) displaced the GHG emissions associated with that consumption had it been produced instead by the electricity mix from GRE. The City purchased 8,758 MWh of RECs in 2022 and 8,322 MWh in 2023. The 2023 amount equaled 52% of the actual MWh consumed by all City operations. The effect was to reduce the total GHG emissions in 2023 to the point that emissions were -61% lower than in the 2005 Base Year. The green line in Figure 1 shows the City needing to hit the -60% reduction mark by 2040 in order to meet its ultimate goal of 80% reduction by 2050. This means the City already achieved that level of reduction a full 17 years ahead of schedule. If the City can continue this rate of GHG reduction, it will meet its 80% reduction goal around 2035, 15 years ahead of schedule.

Section 3.3 contains more information about RECs, and how renewable energy is the source of virtually all electrical power consumed by City operations.

Energy consumption (as measured by Btus) was -9% lower in 2023 compared to 2005 (Figure 10) even with the additional building space and increased production of potable water.[10]

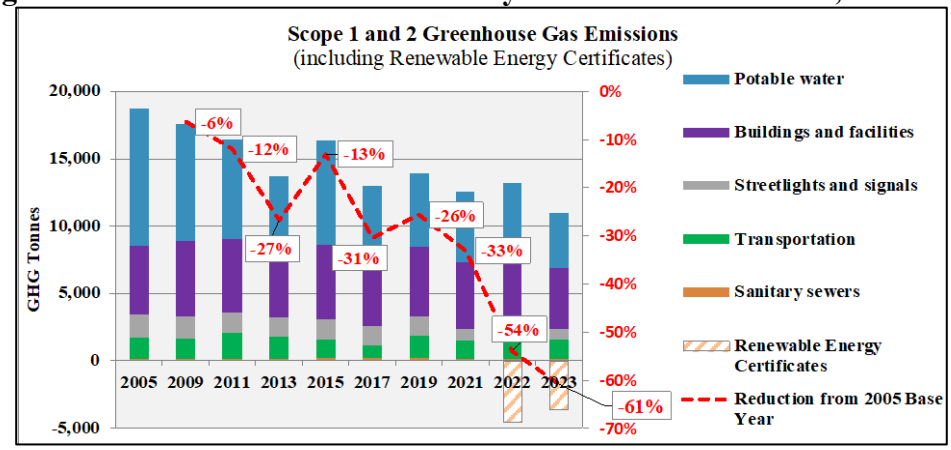
Figure 2: Greenhouse Gas Emissions (tonnes), 2005-2023

City Operations Emissions	2005	2009	2011	2013	2015	2017	2019	2021	2022	2023	Change Since 2005
Scope 1 and 2 Emissions											
Electricity, natural gas, & generators:	17,180	16,015	14,558	12,073	14,895	12,028	12,286	11,160	11,736	9,466	-45%
Buildings and facilities	5,060	5,626	5,424	4,542	5,535	4,943	5,123	4,983	5,316	4,467	-12%
Streetlights and signals	1,757	1,621	1,515	1,416	1,473	1,359	1,503	797	1,008	797	-55%
Potable water	10,231	8,650	7,471	5,963	7,688	5,552	5,473	5,238	5,270	4,079	-60%
Sanitary sewers	132	117	149	152	200	174	188	143	142	123	-7%
Transportation:	1,556	1,530	1,927	1,629	1,403	986	1,630	1,378	1,467	1,460	-6%
Public Works and fleets	1,470	1,471	1,852	1,570	1,390	864	1,520	1,321	1,389	1,387	-6%
Contracted services	81	54	70	33	9	93	102	54	47	37	-54%
Official travel	5	5	5	25	3	29	8	3	31	35.9	571%
Subtotal GHG emissions	18,736	17,545	16,486	13,701	16,298	13,013	13,916	12,538	13,203	10,926	-42%
Change from 2005 Base Year		-6%	-12%	-27%	-13%	-31%	-26%	-33%	-30%	-42%	
Renewable Energy Certificates (RECs) [1]									-4,576	-3,598	
Total Scope 1 & 2 GHG emissions	18,736	17,545	16,486	13,701	16,298	13,013	13,916	12,538	8,627	7,327	-61%
Normalized GHG emissions:											
Normalized for electricity emission factors (excluding RECs)	18,736	18,132	17,930	15,723	17,790	16,176	16,610	15,858	17,367	15,628	-17%
Per-FTE GHG (incl. RECs)	67.6	54.0	52.4	44.4	60.1	46.5	47.5	43.3	29.7	23.7	-65%
Per-capita GHG (incl. RECs)	0.31	0.29	0.28	0.22	0.26	0.21	0.22	0.19	0.13	0.11	-63%
Per-household GHG (incl. RECs)	0.77	0.71	0.69	0.55	0.65	0.52	0.55	0.49	0.33	0.28	-63%
Scope 3 Emissions:											
Solid Waste management	107	97	98	88	77	83	89	106	94	101	-6%
Sanitary sewer treatment	5,962	4,228	3,818	3,279	3,054	2,971	2,992	2,770	2,025	1,897	-68%
Total Scope 3 GHG emissions	6,069	4,325	3,916	3,367	3,131	3,054	3,081	2,876	2,118	1,998	-67%

Notes:

(1) Renewable Energy Certificates (RECs) are issued for each megawatt-hour of renewable electricity added to the grid. They serve as an accounting tool for renewable energy in the mixed-source power grid. RECs represent the environmental benefits of renewable energy, thus, no GHG emissions are associated with them per the ICLEI Protocol.

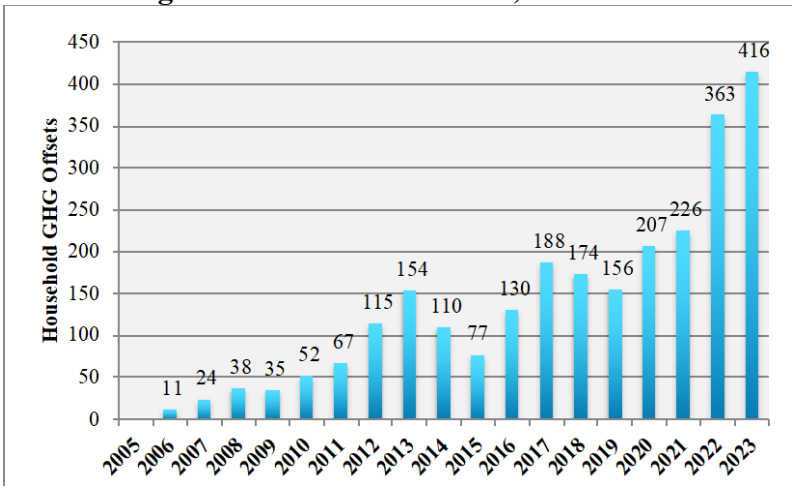
Figure 3: Greenhouse Gas Emissions by Sector and Reductions, 2005-2023



[10] Energy data is not available for official travel.

2.2. Household Offsets: One way to put the value of these GHG reductions into perspective is to consider them offsetting other emissions. The average Burnsville household's emissions equal about 30 tonnes of GHG per year.[11] Over the 19-year Study Period, the City's annual GHG reductions below the 2005 Base Year's emissions totaled about 76,000 tonnes, almost 4,000 tonnes per year on average. This would offset the equivalent, annual emissions from about 2,500 households over the 19-year Study Period, or about 134 households on average each year (Figure 4).[12]

Figure 4: Household Offsets, 2006-2023



2.3. Causes of the Changes in Emissions: Figure 5 illustrates the 4 primary factors that account for this estimated 76,000-tonne decrease in the GHG footprint from City operations over the 19-year Study Period:

- **#1, Reduced Electric Utility Emission Factors:** Ever-declining, electric utility emission factors were the primary reason for the reduced emissions, nearly 35,000 tonnes. The blended emission factor from the 3 utilities that provide power was -38% lower in 2023 than in 2005 due to improved efficiency at the utilities, and less reliance on coal and more on natural gas and renewable fuels (Figure 14). This means that a kilowatt hour (kWh) of power consumed in 2023 resulted in far fewer GHG emissions than in the 2005 Base Year (Figure 5). Reduced utility emission factors are estimated to account for 46% of the reduced emissions over the 19-year Study Period.

- **#2, Reduced Electricity Consumption:** Electricity consumption is the largest source of GHG emissions (83% of the total since 2005, excluding RECs), and reduced electricity consumption is the second largest portion of GHG emission

[11] The data for the citywide greenhouse gas emissions attributable to the average household in Burnsville are from the Regional Indicators Initiative (years 2007 to 2021). Linear regression analysis provided estimates for other years. Source: http://www.regionalindicatorsmn.com.

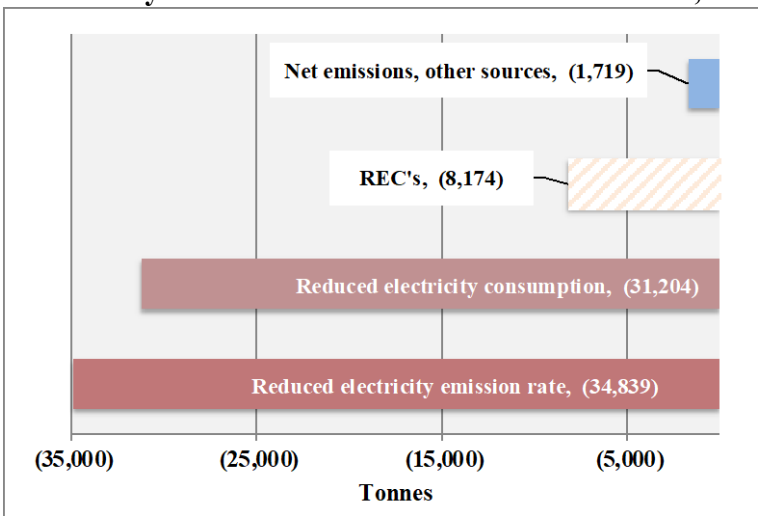
[12] No reductions are shown for 2005 in Figure 4 because it is the Base Year for estimating subsequent emission reductions.

reductions, an estimated 31,200 fewer tonnes (47% of the total, excluding RECs). The primary factors were equipment upgrades for the production of potable water and, to a much lesser extent, lighting upgrades to LED fixtures. Electricity consumption from potable water production in 2023 was -38% lower than in 2005. Electricity conservation is estimated to account for 41% of the reduced emissions over the 19-year Study Period.

- **#3, Renewable Energy Certificates:** The City's purchase of nearly 9,000 MWh of RECs in 2022 and 2023 accounted for 12% of the reductions over the 19-year Study Period (for more information, see Section 3.3).

- **#4, Other sources:** Other emission sources resulted in a net decrease of about 1,700 tonnes, which equaled 2% of the total decrease in emissions over the 19-year Study Period.

Figure 5: Primary Causes of Greenhouse Gas Reductions, 2005-2023



2.4. Normalizing Emissions: To have a better *apples-to-apples* comparison over the 19-year Study Period, the data in Figure 2 and 6 include normalized amounts to account for the following factors:

- **Electricity emission factors:** As mentioned above, the 3 electric utilities that produce the power used by the City have decreased their GHG emission rates (GHG per MWh) since 2005 such that the blended rate for the City's electricity consumption in 2023 was -38% lower than in the 2005 Base Year. The analysis accounts for this by assuming the emission rates remained unchanged since 2005. Excluding RECs, the normalized emissions for facilities and emission factors in 2023 were -17% lower (the red dashed line in Figure 6) compared to the actual -42% reduction (the dashed black line in Figure 6). The solid black line in Figure 6 shows the actual emissions total including the RECs.

- **Demographic factors:** Emissions are affected by the growth in population and households since the 2005 Base Year (both 6% higher) because more people mean more demand for City facilities and services (e.g., increased maintenance for roads, sewers, buildings, and parks; and water, police, and fire services, etc.). This is also true for the growth in the number of City employees (12% larger in 2023 than in 2005) because more employees mean more consumption of energy in facilities and fuels in City vehicles and equipment. Figure 7 illustrates how emissions measured on a per-capita and a per-FTE basis fluctuate over time and also trend lower due primarily to the factors described above in 2.3 and in Figure 5.

Figure 6: Total and Normalized Greenhouse Gas Emissions for Electric Emission Factors, 2005-2023

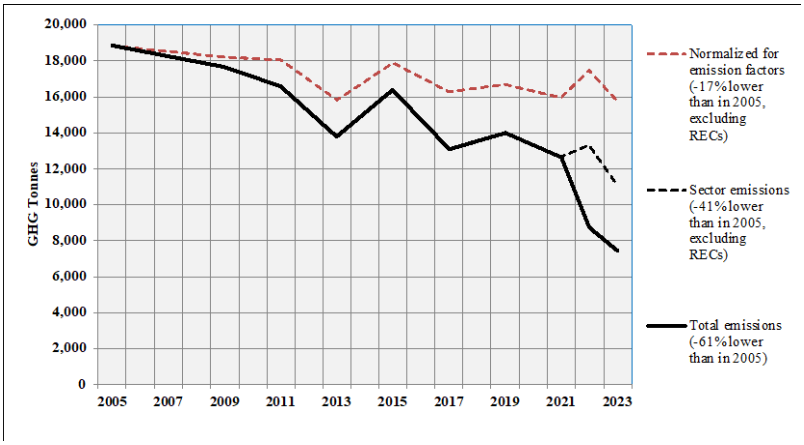
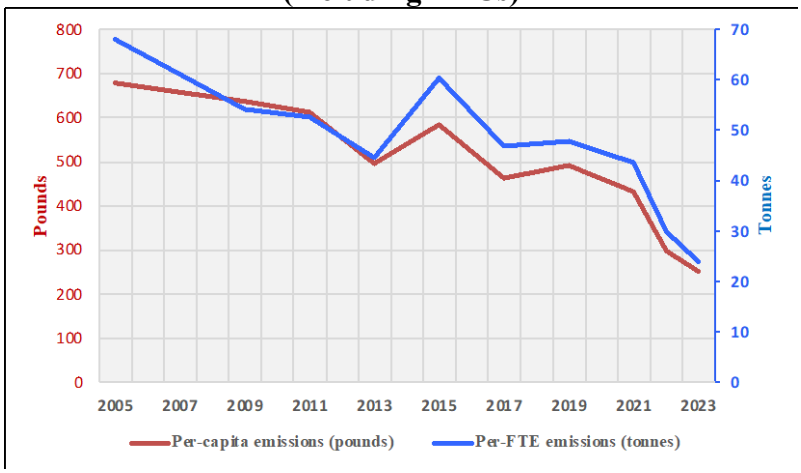


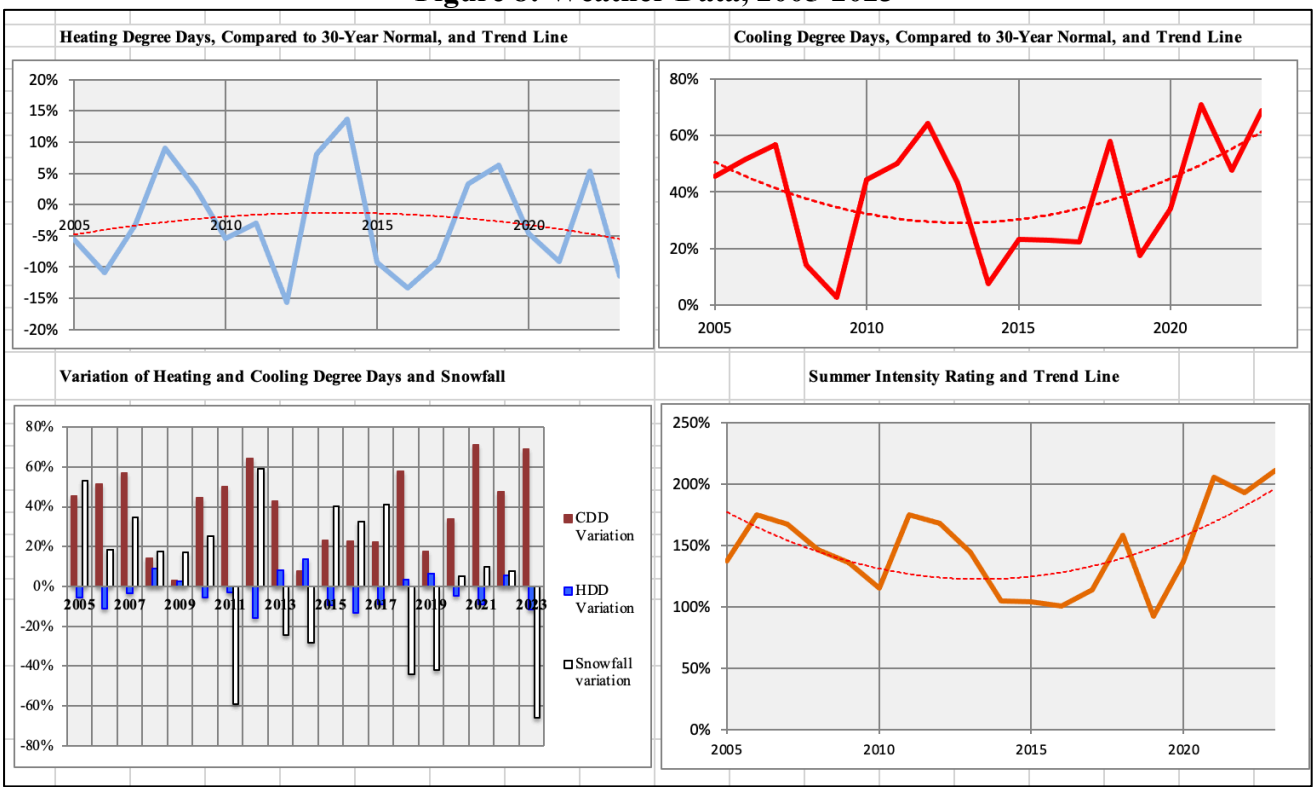
Figure 7: Emissions on a Per-Capita and Per Full-Time-Equivalent-Employee Basis, 2005-2023 (including RECs)



2.5. Weather Factors: Weather variations affect emissions, especially winter weather and snowfalls. The upper two charts in Figure 8 graph variations from "30-year normals" for cooling and heating degree days from 2005 to 2023. The trend lines show that since about 2014, heating degree days have been decreasing, and cooling degree days

have been increasing. This is consistent with the Minnesota Department of Natural Resources predictions for climate change effects in Minnesota.

Figure 8: Weather Data, 2005-2023



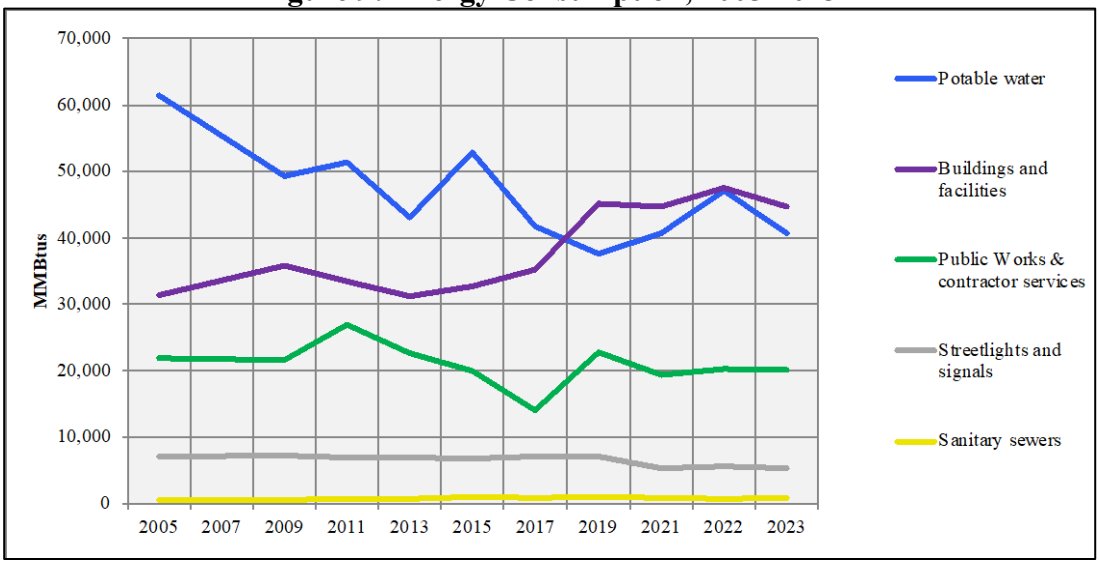
The chart on the lower left shows the same data as bars, plus it adds snowfall amounts. The higher cooling degree days (the red bars), the greater the demand for electricity-based air conditioning. The further the heating degree days (the blue bars) and the snowfall variation (the white bars) are below the X-axis, the greater the demand for natural gas and snowplowing operations.

The chart on the lower right combines the summer data into an "intensity rating." It reflects both temperature and precipitation in a single number to characterize the stress on the plant world and the demand for irrigation. The intensity rating is derived by subtracting the percentage of precipitation that is above 100% of "normal" from the percentage of cooling degree days (CDD) that were above 100% of "normal." Higher precipitation moderated the adverse impacts higher summer temperatures had on plants and their irrigation needs. When precipitation was below 100% of normal, the percent it is below 100% is added to the percent CDD were above normal to reflect the additive intensity of summer temperatures and lack of precipitation, and need for additional irrigation. As with the top two charts, the trend line since about 2014 has been increasing indicating greater summer intensities of higher temperatures combined with lower precipitation when compared to the "30-year normals."

The current ICLEI Protocol allows normalizing for heating degree days but not cooling degree days. However, normalizing for winter weather would have a very minimal effect on the natural gas consumption data (a de minimis effect). Instead of a quantitative adjustment of the natural gas consumption that accounts for the possible effects of winter weather, the Assessment includes this detailed weather information and a brief summary description of the annual weather in the Detailed Summary in Appendix A

2.6. Indicators and Energy Consumption: Figure 9 illustrates energy consumption by sectors throughout the Study Period. By charting energy instead of GHG emissions, it eliminates the effects of declining electric utility emission rates and RECs on the curves.[13] The role of potable water and its sharp energy reductions (and increases in 2015 and 2022) cannot be understated. The chart shows the relatively flat lines of energy consumption for the other sectors over the 19-year Study Period, with the exception of the buildings and facilities category, which climbed significantly after 2013 and surpassed the potable water sector in 2019 and in later study years. Figure 10 includes a list of key indicators that affect GHG emissions and other factors for all 10 study years.

Figure 9: Energy Consumption, 2005-2023



[13] The data for Figure 8 do not include official travel.

Figure 10: Indicators, 2005-2023

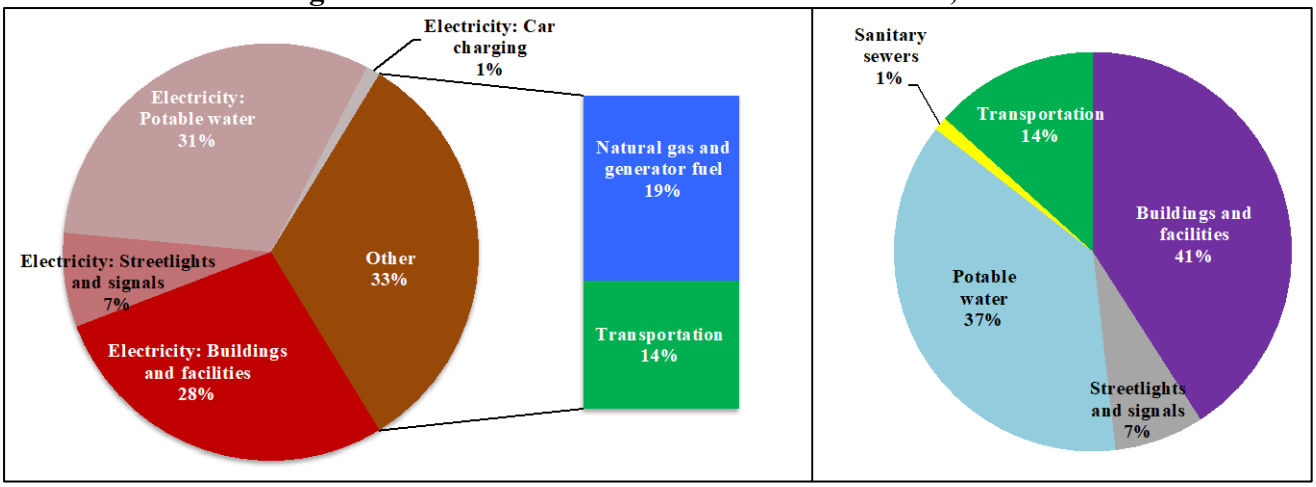
Category	2005	2009	2011	2013	2015	2017	2019	2021	2022	2023	Change Since 2005
Electricity, natural gas, & generators:											
Buildings and facilities											
Electricity (MWh)	4,671	5,717	5,844	4,987	5,815	5,622	5,441	4,957	5,462	5,337	14%
Natural gas (therms)	148,612	161,417	127,706	137,831	126,163	158,794	261,652	216,569	284,060	260,485	75%
Emergency generators (gal.)	3,826	1,075	5,479	3,292	1,759	1,297	3,405	5,756	3,340	3,400	-11%
Energy (MMBtu)	31,315	35,793	33,451	31,243	32,697	35,236	45,191	44,717	47,494	44,717	43%
Streetlights and signals (MWh)	2,077	2,097	2,049	2,019	1,964	2,062	2,090	1,533	1,633	1,550	-25%
Energy (MMBtu)	7,087	7,156	6,990	6,889	6,700	7,034	7,131	5,289	5,573	5,289	-25%
Potable water											
Amount (billions of gal.)	2.6	2.9	3.3	3.4	3.7	3.0	3.0	3.4	3.3	3.3	27%
Electricity (MWh)	14,415	13,076	11,585	10,686	12,413	10,974	9,830	10,746	11,222	8,922	-38%
Natural gas (therms)	122,157	47,441	118,664	65,798	104,556	43,808	40,884	112,387	99,582	114,907	-6%
Energy (MMBtu)	61,401	49,358	51,393	43,039	52,808	41,824	37,629	41,934	48,248	41,934	-32%
Sanitary sewers (MWh)											
Electricity (MWh)	148	143	190	202	270	241	278	217	211	218	47%
Natural gas (therms)	100	0	67	177	370	429	131	415	324	452	352%
Energy (MMBtu)	517	489	655	709	959	866	963	791	754	791	53%
Subtotal electricity (MWh)	21,312	21,033	19,667	17,893	20,462	18,899	17,640	17,453	18,529	16,028	-25%
Energy (MMBtu)	72,716	71,765	67,104	61,052	69,817	64,482	60,187	54,686	63,221	54,686	-25%
Subtotal natural gas (therms)	270,869	208,857	246,437	203,807	231,089	203,031	302,667	329,371	383,966	375,844	39%
Energy (MMBtu)	27,087	20,886	24,644	20,381	23,109	20,303	30,267	37,584	38,397	37,584	39%
Transportation:											
Public Works and fleets responsibilities:											
Liquid fuel consumption (gal.)	179,185	180,413	216,261	189,790	170,302	119,600	180,761	159,876	166,918	166,358	-7%
Contracted services (gal.)	8,000	5,376	6,960	3,289	950	9,229	10,129	5,333	4,694	3,673	-54%
Subtotal (gal.)	187,185	185,789	223,221	193,079	171,252	128,829	190,890	165,209	171,612	170,032	-9%
Energy (MMBtu)	21,963	21,653	26,867	22,687	19,914	14,081	22,780	19,441	20,267	20,095	-9%
Official travel (GHG tonnes)	5	5	5	25	3	29	8	3.0	31.5	35.9	571%
Other indicators:											
Energy consumption (MMBtu, excludes official travel and wastewater treatment)	121,766	114,304	118,615	104,121	112,839	98,866	113,233	111,712	121,885	112,366	-8%
Reduction of blended electricity emission factor from 2005		-4%	-9%	-17%	-9%	-21%	-19%	-26%	-30%	-38%	-38%
City employees (FTE)	277	325	315	309	271	280	293	290	291	310	12%
City population	61,262	61,047	59,565	61,300	61,908	62,239	62,785	64,420	64,522	64,653	6%
City households	24,380	24,723	23,843	24,854	24,990	25,252	25,405	25,657	25,834	25,904	6%
Weather summary	Hot and wet summer, low heating degree days (HDD)	Normal cooling degree days (CDD) but very dry summer with normal HDD	Very hot and dry summer, normal HDD and very heavy snowfall	Hot and wet summer with low HDD and low snowfall	Hot and wet summer with low HDD and low snowfall	Hot and very wet summer with low HDD and very low snowfall	Normal winter temp, very heavy snowfall, warm and wet summer	Cooler winter, light snowfall, very hot summer drought	Cooler winter, light snowfall, very hot summer, drought	Warmer winter, very heavy snowfall, very hot summer, drought	

3. Sources of Emissions

The 2 pie charts in Figure 11 allow easy comparisons of the 2023 data. The chart on the left breaks out the emission sources by fuel type and further defines electricity consumption, which resulted in 67% of the emission total, into its 3 major subcategories. The largest electricity consumer, potable water, accounts for the largest amount of GHG emissions, 31% of the total. Electricity consumption for buildings and facilities (28% of the total), for streetlights and signals (7%), and a final 1% for car charging complete the story for electricity. The percentages broken out in the "Other" wedge of the chart include emissions from natural gas consumption and generator fuels (19%), and 14% for transportation, which includes the consumption of liquid fuels, emissions related to contractor services, and official travel.

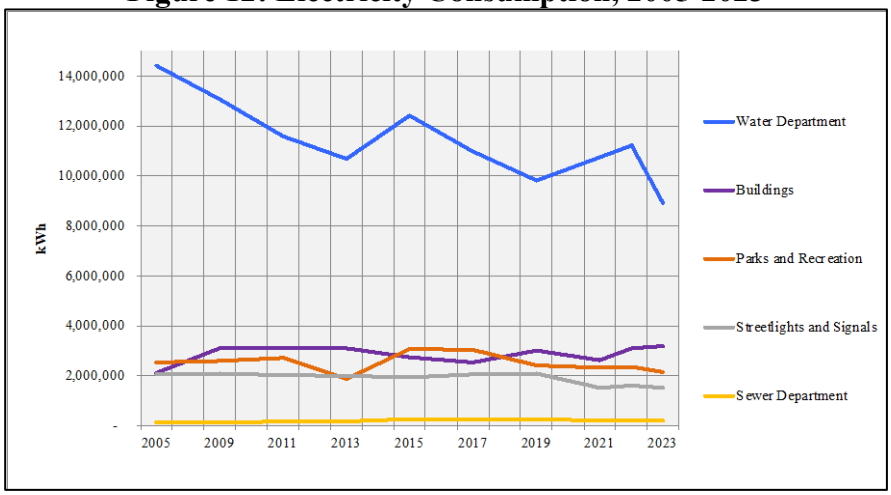
The chart on the right breaks out emissions by sector in 2023. Since the first assessment in 2005, the production of potable water has dominated the story. In 2005, it accounted for 53% of total City emissions. Since then, the category has pumped significantly more water but at much greater energy efficiency. In 2023, it still constituted 37% of total emissions from City operations, but buildings and facilities took over as the top emission category in 2023 with 41% of the total for the year. The transportation category, again, shown with 14% of the total. The rest of the emissions were from streetlights and signals at 7%, and 1% from energy consumption for the sanitary sewer system. Subsequent sections of this Assessment provide additional detail.

Figure 11: Sources of Greenhouse Gas Emissions, 2023



3.1. Electricity: Electricity consumption was -25% lower in 2023 compared to the 2005 Base Year (Figure 10 and 12). GHG emissions from electricity consumption were -45% lower in 2023 than in 2005. When normalized for the blended electricity emission factor, emissions were -23% lower.

Figure 12: Electricity Consumption, 2005-2023



3.2. Electricity Providers and Emission Factors: The City has numerous buildings, parks, wells, pumps, streetlights and signals that consume electricity and natural gas. The City's accounting and facility management staff must deal with about 240 electricity accounts with 3 utilities, nearly 40 natural gas accounts with CenterPoint Energy, and a diesel fuel account for emergency generators. Also, most facilities have multiple accounts.

To serve the City's electricity needs, the following 4 utilities are involved in the generation and distribution of electricity within the City (Figure 13):

- **Dakota Electric Association:** The Dakota Electric Association (DEA)[14] serves the majority of the City. DEA purchases wholesale electricity from Great River Energy, a generation and transmission cooperative in Maple Grove, Minnesota, and distributes electricity to homes, businesses and farms in parts of Dakota, Goodhue, Scott and Rice counties.

- **Xcel Energy:** Xcel Energy[15] distributes electricity in small portions in the north of the City. The company's local generation subsidiary, Northern States Power, generates the electricity.

- **Minnesota Valley Electric Cooperative:** The Minnesota Valley Electric Cooperative (MVEC)[16] distributes electricity to the northwest portion of the City. MVEC is a distribution cooperative that purchases wholesale power from two generation and transmission cooperatives, Great River Energy and Basin Electric Power Cooperative.

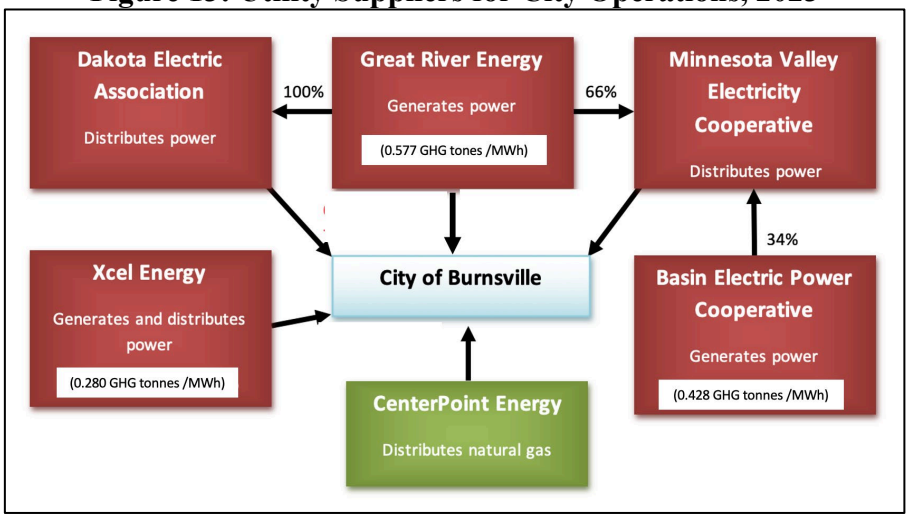
[14] According to the company's website, "Dakota Electric Association is a member-owned, not-for-profit electric utility founded by local farmers in 1937 with the help of the Rural Electrification Administration. With more than 100,000 members, Dakota Electric is the second largest electric cooperative in Minnesota and ranked among the 25 largest electric distribution cooperatives in the nation." https://www.dakotaelectric.com/
[15] http://www.xcelenergy.com/Minnesota/Company/Pages/Home.aspx
[16] http://www.mvec.net/

- **Great River Energy:** Great River Energy (GRE) does not distribute power within the City but rather generates the power that is then distributed by MVEC and Dakota Electric Association.[17]

As mentioned above, the GHG emissions associated with electricity generation vary over time according to a variety of factors, most importantly, the type of generating facility, fuel mix, and percent of renewable and nuclear generation. In addition, utilities purchase electricity from other generators, which can have very different GHG emission rates. As such, the calculation of GHG emissions depends on both the consumption data (in kWh) from the above 3 utilities that distribute power, and the specific emission factors for the 3 electric utilities that generate the power. The GHG emissions were calculated using the emission factors unique to each utility for each of the City's 240 electrical accounts.

The table in Figure 14 and the accompanying graph in Figure 15 address the issue of declining electricity emission factors from 2005 to 2023. They show that Xcel Energy's GHG emission rate was the lowest and it had the largest decline (-55%), followed by MVEC and GRE with declines of -42% and -37% respectively. The table and graph also show the decline of the blended rate, which was -38% lower in 2023 than in 2005. The blended rate is calculated by dividing total electricity consumption by total emissions for each study year. The blended rate is not an average of the emission rates of the 3 power providers. Rather, it would be the emission factor an imaginary fourth utility would calculate based on the power it received from 3 other producers.

Figure 13: Utility Suppliers for City Operations, 2023

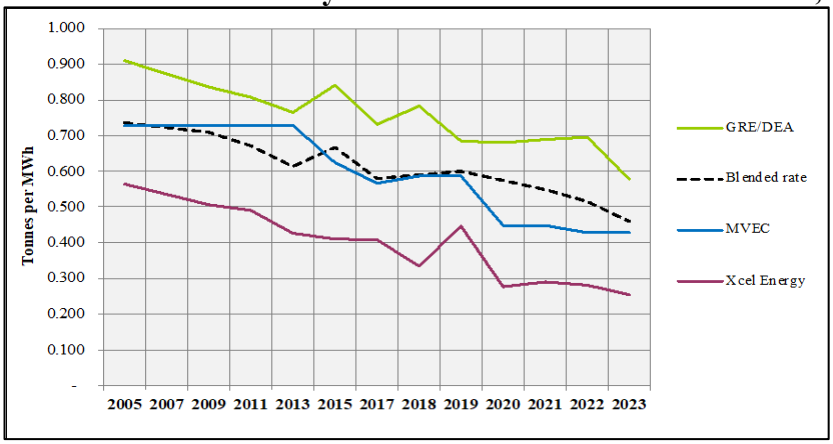


[17] According to its website, Great River Energy is a "not-for-profit electric cooperative owned by its 28 member cooperatives. We generate and transmit electricity for those members, located in the outer-ring suburbs of the Twin Cities up to the Arrowhead region of Minnesota and down to the farmland region in the southwestern portion of the state." http://www.greatriverenergy.com/aboutus/whoweare/

Figure 14: Electric Utility Greenhouse Gas Emission Factors, 2005-2023

Utility Rates (tonnes GHG per MWh)	2005	2007	2009	2011	2013	2015	2017	2018	2019	2020	2021	2022	2023	Change Since 2005
Emission factors:														
Xcel Energy	0.565		0.505	0.490	0.425	0.410	0.409	0.335	0.447	0.277	0.289	0.280	0.254	-55%
GRE/DEA	0.909		0.836	0.807	0.764	0.841	0.732	0.782	0.684	0.679	0.689	0.697	0.577	-37%
MVEC	0.727		0.727	0.730	0.730	0.624	0.566	0.587	0.587	0.448	0.448	0.428	0.428	-41%
Blended rate	0.737		0.708	0.671	0.612	0.667	0.579		0.599		0.548	0.516	0.460	-38%
Percent blended emission factor smaller than 2005 base rate			-4%	-9%	-17%	-9%	-21%	-100%	-19%	-100%	-26%	-30%	-38%	

Figure 15: Chart of Electric Utility Greenhouse Gas Emission Factors, 2005-2023



3.3. Renewable Energy: The following describes how, in 2022 and 2023, renewable energy provided virtually 100% of the electricity consumed by City facilities and operations.[18] It begins with a description of Renewable Energy Certificates, which were crucial to the City accomplishing a -61% GHG reduction from the 2005 Base Year.

Defining Renewable Energy Certificates: Renewable Energy Certificates (RECs) are issued for each megawatt-hour of renewable electricity added to the grid. They serve as an accounting tool for renewable energy in the mixed-source power grid. RECs represent the environmental benefits of renewable energy, with only the final consumer of the REC having the right to claim these benefits. Once a REC is sold, the owner of the renewable energy generator relinquishes the claim to using renewable electricity, regardless of where the electrons flow.[19]

[18] The exception is the power provided by MVEC. However, MVEC provided only 0.5% of total electricity in 2023 and 84% was non-renewable. Therefore, 99.6% of power consumed in 2023 by all City facilities and operations was supplied by renewable sources.

[19] A Renewable Energy Certificate (REC) represents the environmental attributes of renewable energy, and it is separable from the energy itself. As explained by the EPA, "Because the physical electricity we receive through the utility grid says nothing of its origin or how it was generated, RECs play an important role in accounting, tracking, and assigning ownership to renewable electricity generation and use. On a shared grid, whether from on-site or off-site resources, RECs are the instrument that electricity consumers must use to substantiate renewable electricity use claims." (Source: https://www.epa.gov/greenpower/renewable-energy-certificates-recs) "Selling the RECs [from renewable energy generation] transfers your claim on the renewable attributes of the system to the buyer of the RECs." (Source: https://www.epa.gov/greenpower/making-environmental-claims)

Renewable Energy Programs: The City participates in the two renewable energy programs described below:

- **DEA's Wellspring Renewable Energy Program:** Starting in 2022, the City has subscribed to DEA's Wellspring Renewable Energy purchasing program[20] to offset the majority of electricity used in City operations located in DEA's service area. In 2023, the City's power supply through Great River Energy (which provides the power that DEA distributes) had 25% renewables. The City is covering the remaining 75% of its power needs through DEA's Wellspring Renewable Energy program to accomplish 100% renewable coverage for those facilities within DEA's service area. In 2021, DEA provided 58% of the power consumed by City operations, and that electricity accounted for 77% of the total GHG emissions. The City retains the RECs for this electricity consumption, so the City's GHG emissions are reduced accordingly, per the ICLEI Protocol.

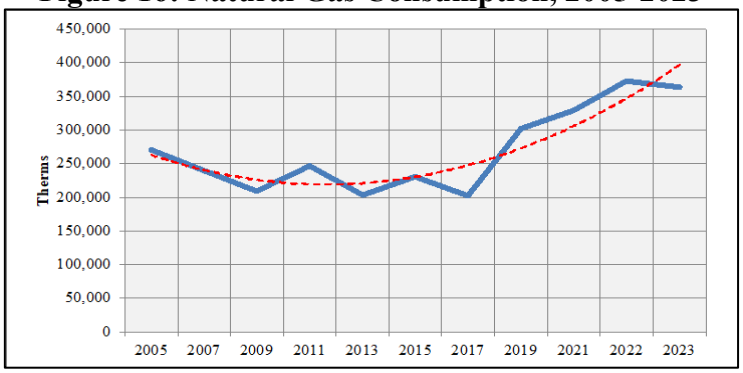
  In other words, each MWh of consumption that was produced by renewable energy through the program (i.e., 1 REC) displaces the GHG emissions associated with that consumption had it been produced instead by the electricity mix from GRE. The City purchased 8,758 MWh of RECs in 2022 and 8,322 MWh in 2023. The 2023 amount equaled 52% of the actual MWh consumed for all City facilities.

- **Solar Energy and Xcel's Solar*Rewards Community program:** Since 2017 and 2019, the City has entered into 25-year lease agreements with 3 companies for community solar garden (CSG) energy. The City does not own the solar gardens; instead, they generate power that is fed to Xcel Energy. The City does not receive or sell the RECs in Xcel's Solar*Rewards Community program. Xcel has an agreement with the solar garden owner. The owner can either retain the RECs or sell them to Xcel Energy, but the City is not a part of the process. As such, the power purchased through community solar gardens does not reduce the GHG emissions for the City in terms of this Assessment. However, CSG agreements have saved the City money on energy costs, saving approximately $364,000 through October 2023. The power the City receives via these CSG agreements equal 100% of the power distributed by Xcel for City facilities and operations.

3.4. **Natural Gas:** Natural gas consumption fluctuated over the Study Period with the lowest consumption in 2017, which was -25% lower than in 2005 (Figure 16).

[20] This is DEA's description of the program: "Those who participate in the Wellspring program are purchasing renewable energy credits (RECs). For every 1,000 kilowatt-hours (kWhs) of clean, renewable electricity generation, a REC is created. A REC embodies all of the environmental attributes of the generation and can be tracked separately from the underlying electricity. Dakota Electric provides Wellspring energy to you through Great River Energy, our wholesale power supplier. This means you can support renewable energy and its future without having to build or buy anything."

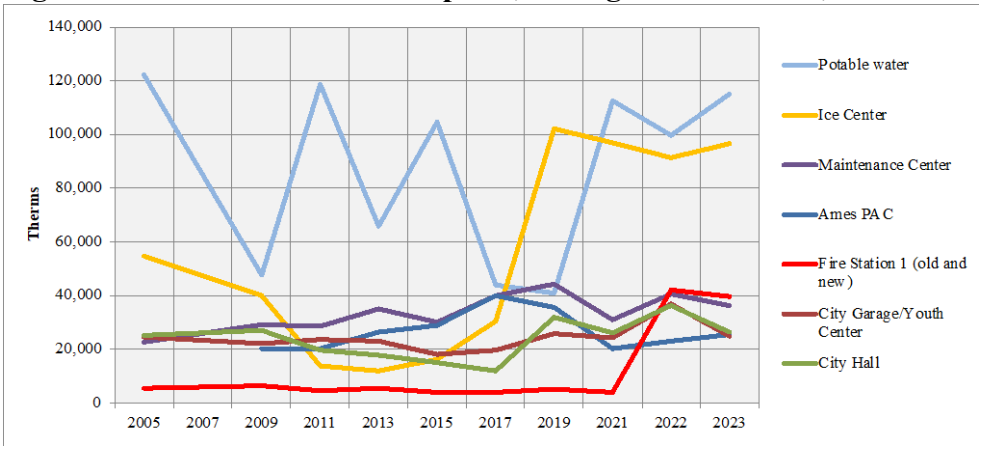
Figure 16: Natural Gas Consumption, 2005-2023



Consumption in 2022 and 2023 was higher than the 2005 Base Year (42% and 39% respectively). There was a similar pattern for the 7 largest gas consumers (Figure 17). Total consumption for the group declined from 2005 through 2017 (2017 was -26% lower than in 2005) but increased significantly in subsequent years. Consumption in 2022 and 2023 was larger than in 2005 by 45% and 43% respectively. The primary reason for the increases were major increases in consumption at the Ice Center (77% higher), at the Maintenance Center (59% higher), and at the Ames PAC (26% higher than the 2009 Base Year). The new Fire Station1 had a major increase in consumption. When compared to the average consumption at the former station from 2005 to 2021, consumption in 2023 was more than 8 times as high.

Among the 7 largest consumers (Figure 17), only potable water production had significantly less consumption than the Base Year (-6% less in 2023 compared to 2005). This decrease was, in part, due to the extremely high consumption in the 2005 Base Year, which skews the reduction. If the comparison were relative to the average consumption from 2009 to 2023 (skipping the 2005 outlier), the 2023 consumption was 38% higher than that average. However, the system also produced 27% more water than in 2005.

Figure 17: Natural Gas Consumption, 7 Largest Consumers, 2005-2023



Consumption associated with the production and distribution of potable water zig-zagged up and down over the Study Period, primarily due to the upgrading and

addition of facilities and changing demands for electricity and natural gas. The potable water analysis in Section 7 examines total energy consumption. A focus on natural gas alone doesn't provide a complete picture.

3.5. Seven Largest Sectors of Emissions and Emission Reductions: Figures 18 and 19 focus on the emissions from the 7 largest facilities (Water Treatment Plant, wells and Kraemer Quarry, Nicollet Reservoir, liquid fuels, Ice Center, Ames PAC, and the City Hall/Police Dept.). Figure 18 shows emissions over time and Figure 19 illustrates the share of the emission total in 2023. These 7 sectors accounted for 70% of the City's total emissions in 2023. Of the 70 annual, data points for the 7 facilities over the 19 Study Period, almost all were below the 2005 Base Year emission levels. The exceptions are the Ames PAC from 2011 to 2019 and 6 other instances for other facilities. However, emissions for the Ames PAC were -5% lower in 2023 than in its 2009 Base Year. If the Ames PAC is excluded, the emissions for the other 6 facilities were -45% lower in 2023 than in 2005.

Figure 18: Seven Largest Sectors of Emissions, 2005-2023

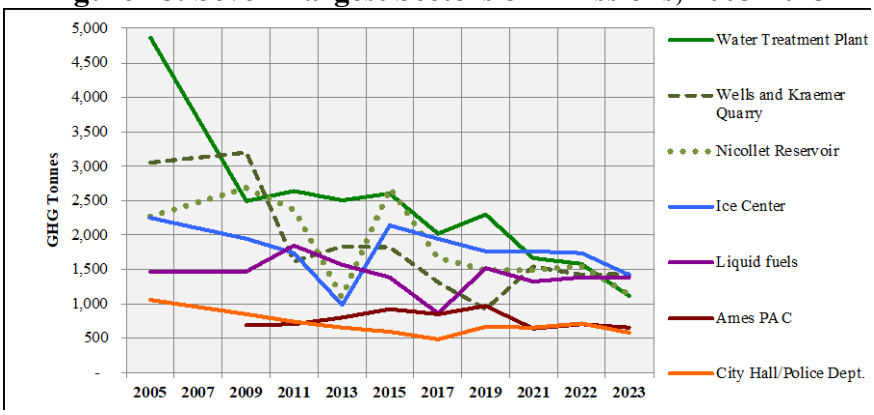
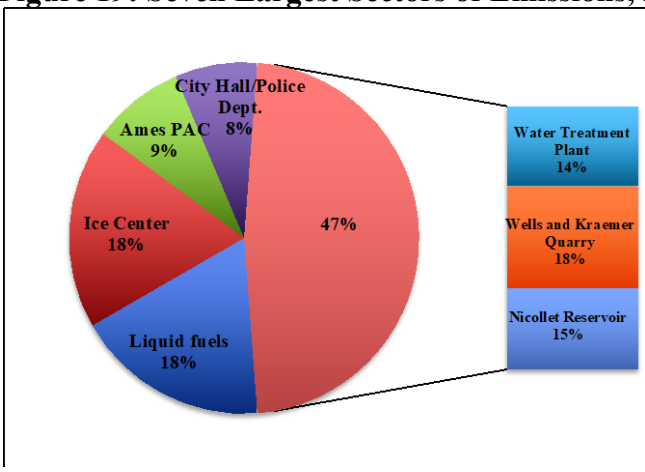


Figure 19 emphasizes the role of potable water production, which accounted for 47% of the emissions in 2023. The Ice Center was tied at 18% of the total with liquid fuels as the next largest sources. The Ames PAC and City Hall/Police Dept. were at 9% and 8% respectively.

Figure 19: Seven Largest Sectors of Emissions, 2023



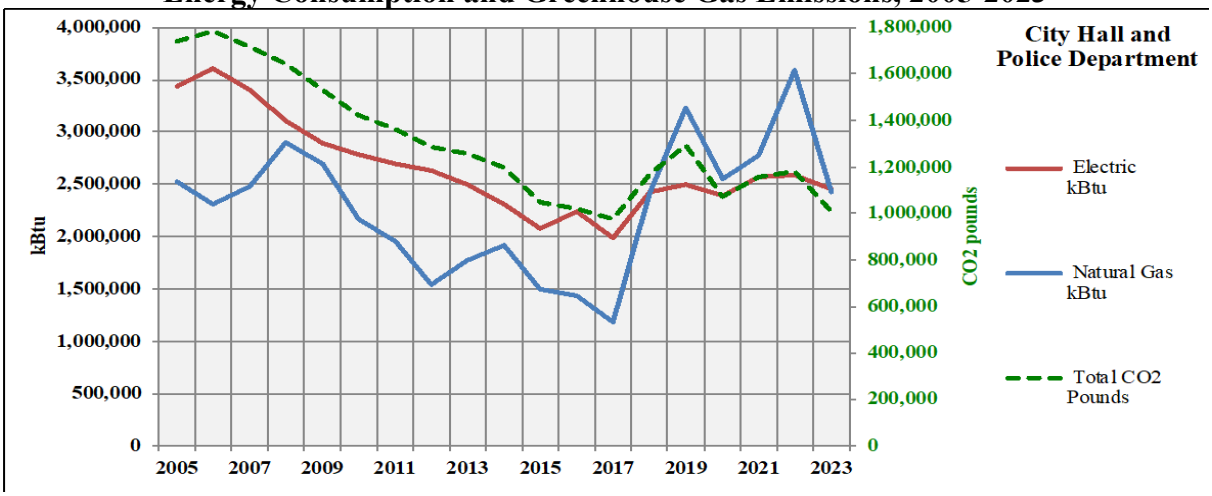
4. Buildings and Park and Recreation Facilities

Buildings and park and recreation facilities accounted for the largest share of total emissions in 2023, 41% of the total (Figure 11). The addition of a significant amount of space since the 2005 Base Year, emissions for buildings alone resulted in emissions that were 26% higher in 2023 than in 2005. Since emissions for park and recreation facilities were -24% lower than in 2005, the combined emissions were only 1% higher in 2023 than in 2005 (Figure 2 and Appendix A).

The following takes a closer look at larger buildings and park and recreation facilities:

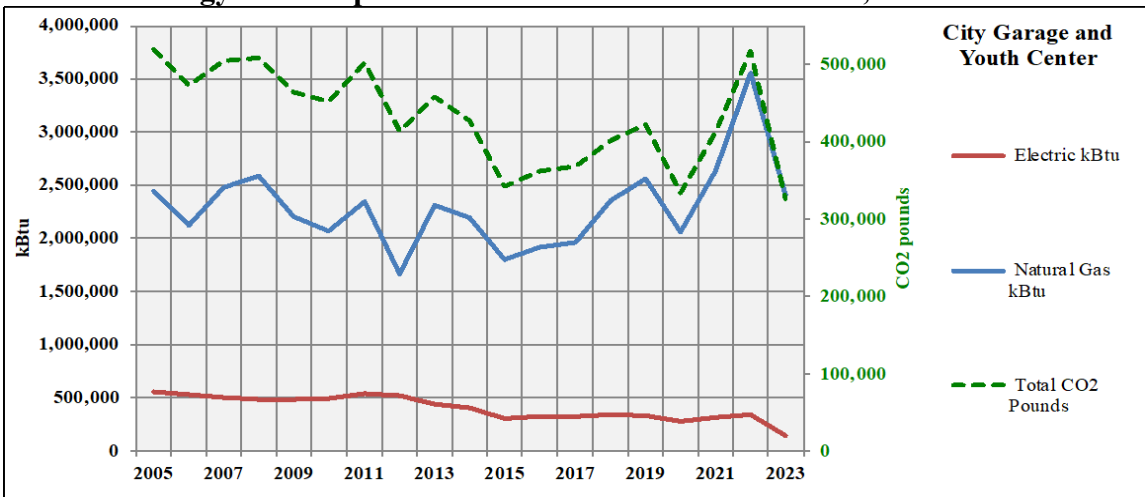
- **City Hall/Police Department:** Energy consumption in the City Hall/Police Department fluctuated since 2005 but was -18% lower in 2023 than in 2005. The Police Department wing was demolished internally and under construction from June 2017 to Feb 2018. The changeout to LED lighting in City Hall/Police Department contributed significantly to the large decrease in electricity consumption in 2023 compared to 2005. However, energy consumption, especially natural gas consumption, jumped up after 2017 (2019 energy use was 81% higher than in 2017). The COVID 19 pandemic obviously had a roll in the large decrease in energy consumption in 2020. Partial recovery in subsequent led to the increase in energy consumption shown on Figure 20, but emissions increased but were still below 2005 levels (-34% lower).

Figure 20: City Hall and Police Department, Energy Consumption and Greenhouse Gas Emissions, 2005-2023



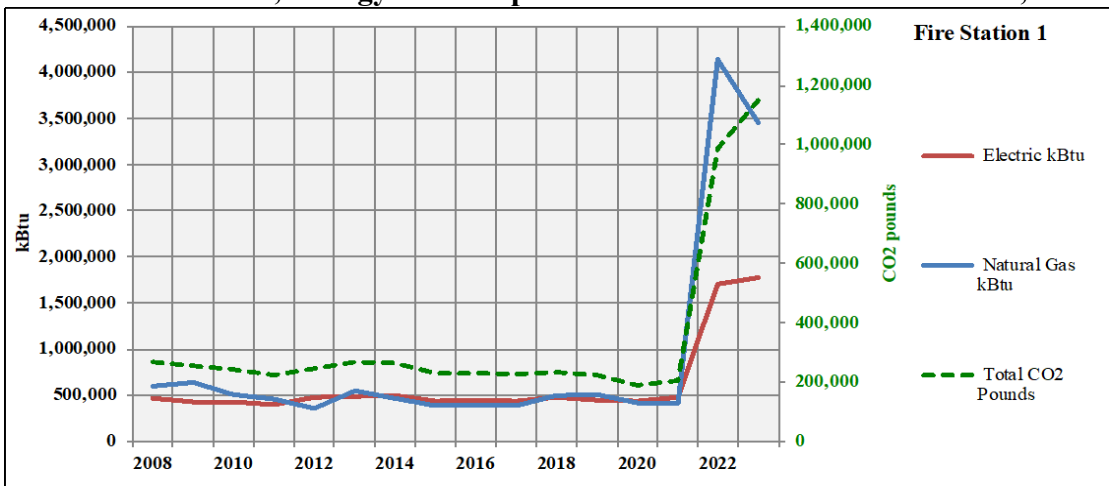
- **City Garage/Youth Center:** Energy consumption at the City Garage/Youth Center fluctuated somewhat (especially natural gas consumption); however, overall energy consumption was -15% lower in 2023 compared to 2005 and emissions were -24% lower (Figure 21).

Figure 21: City Garage and Youth Center, Energy Consumption and Greenhouse Gas Emissions, 2005-2023



- **Fire Stations 1 & 2:** From 2005 to 2021, Fire stations 1 and 2 have similar patterns of natural gas consumption with relatively high amounts in 2008, 2013, and 2014 partially due to the very cold winters, and relatively low in 2012, 2015-2017, partially due to warm winters. Outside winter temperatures will have significant effects on uses with heated garages. Energy consumption for Fire Station 1 was -16% lower in 2021 than in 2008 when it opened and -27% lower for Fire Station 2 than in 2006 when it opened. LED conversions reduced energy consumption. There were normal winter temperatures in 2019 but very heavy snowfall and warm summer (Figures 22 and 23). Emissions in 2021 compared to 2005 were -24% and -34% lower for Fire Station 1 and 2 respectively.

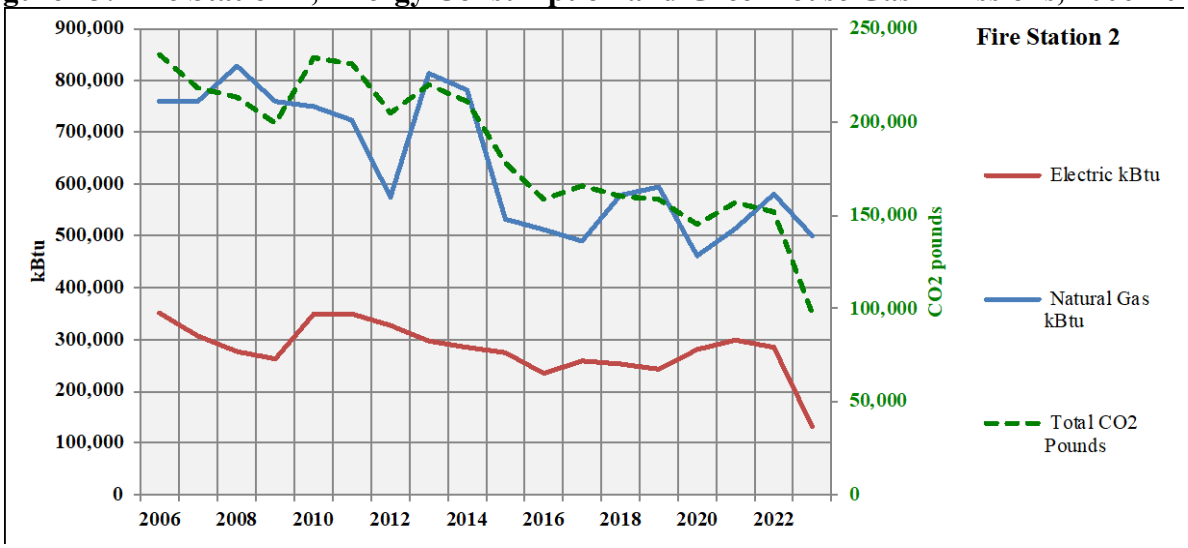
Figure 22: Fire Station 1, Energy Consumption and Greenhouse Gas Emissions, 2008-2023



In 2023, energy consumption and emissions dropped considerably for Fire Station 2. In 2023, it was -43% lower than its 2006 Base Year. Fire station 1 had a steady amount of energy consumption from 2008 to 2021, an average of 927,500 kBtu per year. In 2022, the old Fire Station 1 was replaced by a new one. Energy consumption

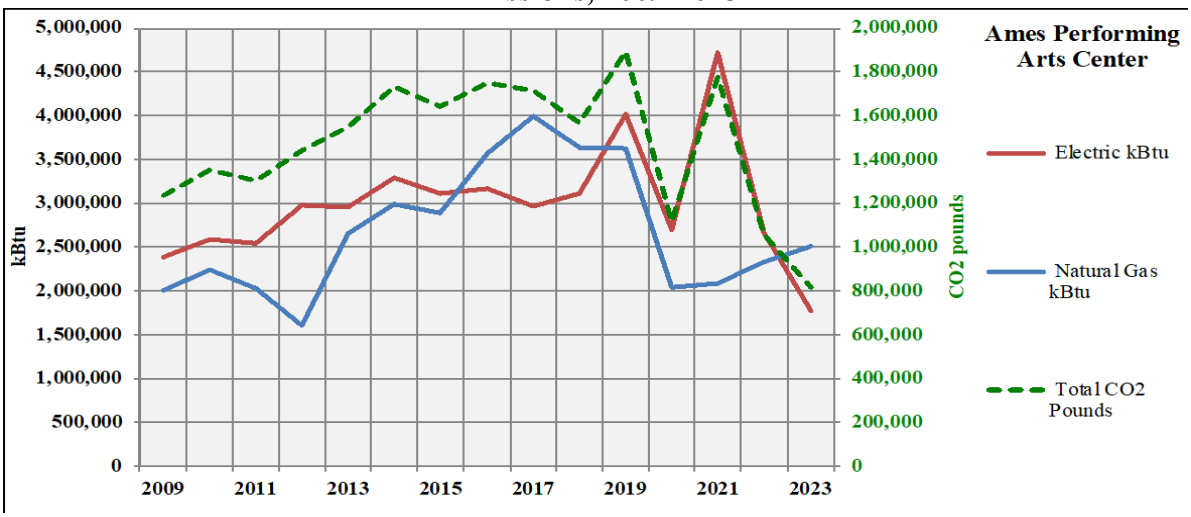
spiked that year of construction, 5 times higher than the average annual consumption over the prior 14 years, and then settled to an amount that was 4.6 times higher than that average. The main driver of the increase was natural gas consumption.

Figure 23: Fire Station 2, Energy Consumption and Greenhouse Gas Emissions, 2006-2023



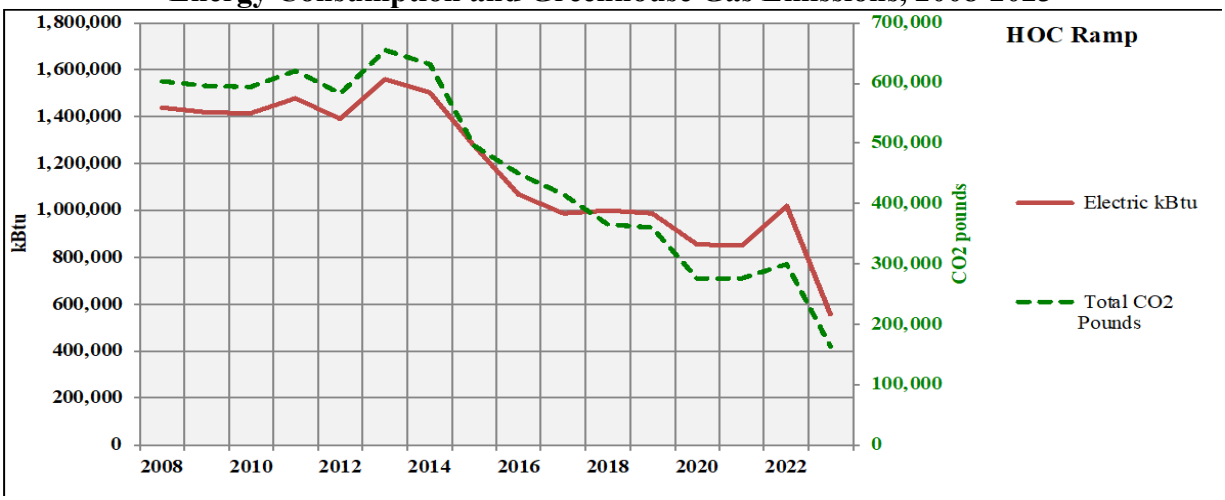
- **Ames Performing Arts Center:** Energy consumption at the Ames Performing Arts Center has increased annually from its first full year operation in 2009 to 2019, primarily due to increased usage of the facility. Compared to 2009, energy consumption in 2019 was 74% higher. Consumption dropped precipitously in 2020 due to the COVID 19 pandemic but then increased in 2021. Overall energy consumption was -3% smaller in 2021 compared to the facility's 2009 Base Year, and emissions were -34% smaller (Figure 24).

Figure 24: Ames Performing Arts Center, Energy Consumption and Greenhouse Gas Emissions, 2009-2023



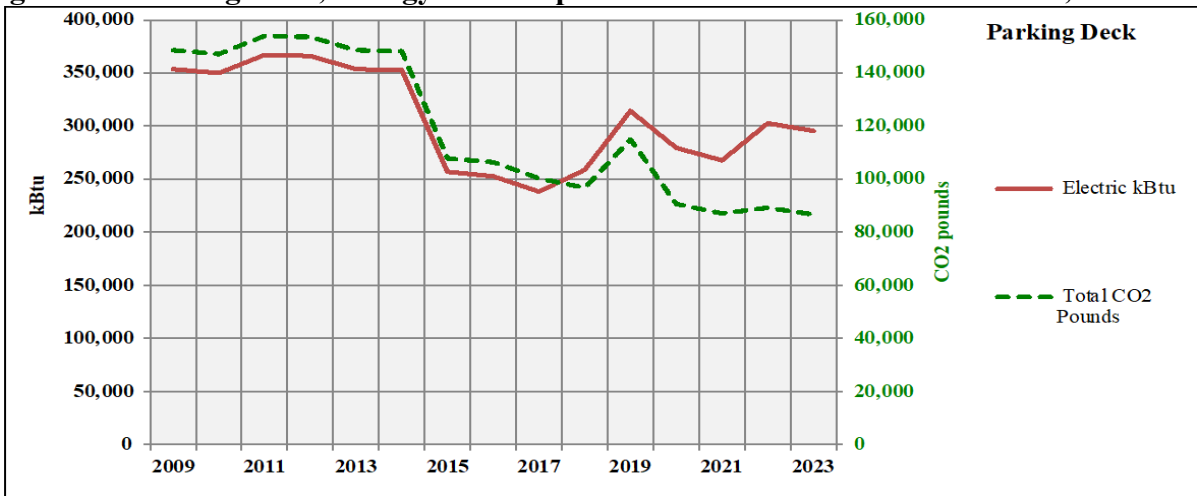
- **Heart of the City Ramp:** Electricity consumption in the HOC ramp was -42% lower in 2023 than in 2008 when the ramp opened due to the City's program to change the lighting to LED fixtures. (Figure 25).

Figure 25: Heart of the City Ramp, Energy Consumption and Greenhouse Gas Emissions, 2008-2023



- **Parking Deck:** Electricity consumption in the Parking Deck was -17% lower in 2023 than in 2009 when the ramp opened due to the City's program to change the lighting to LED fixtures, which was 100% complete by the end of 2017. (Figure 26).

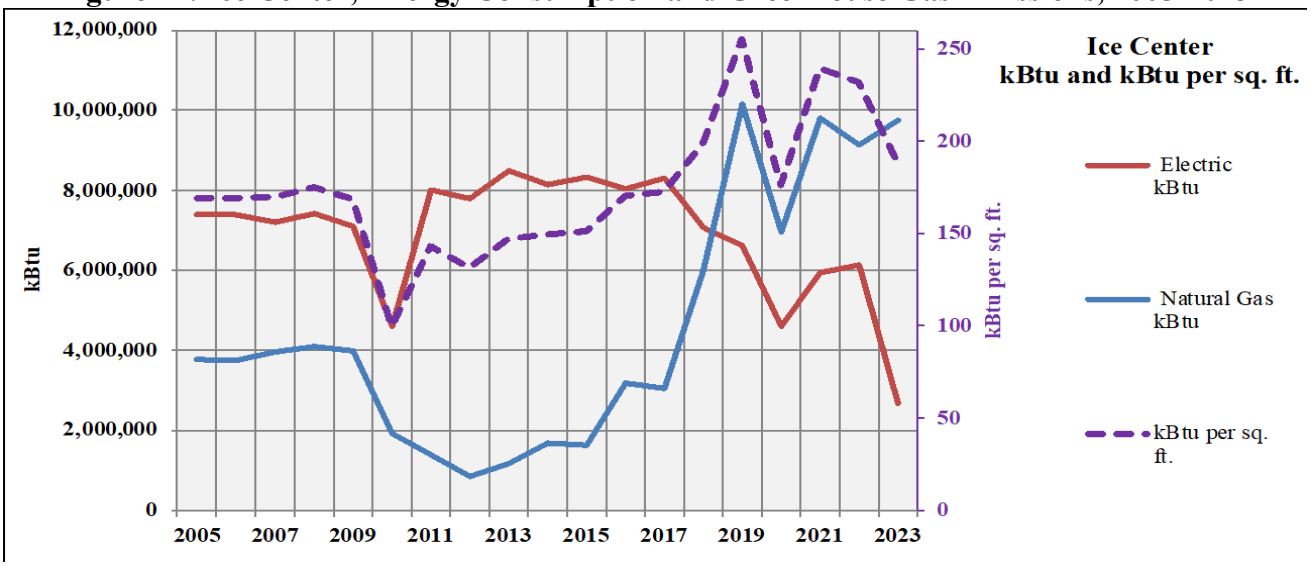
Figure 26: Parking Deck, Energy Consumption and Greenhouse Gas Emissions, 2009-2023



- **Ice Center:** Energy consumption at the Ice Center has fluctuated over time. Electricity consumption was -17% lower in 2022 than in 2005, and much lower in 2023, -64% lower (Figure 27). However, overall energy consumption was 11% higher in 2023 due to a significant increase in gas consumption that began after 2017. The Ice Center was shut down for a big portion of 2010 when the geothermal system was installed and all of the new operating equipment for the arena was installed. The geothermal system is used to maintain the ice, not for building heating and cooling. Facility closures due to

the COVID 19 pandemic clearly were the cause of the major decreases in energy usage in 2020.

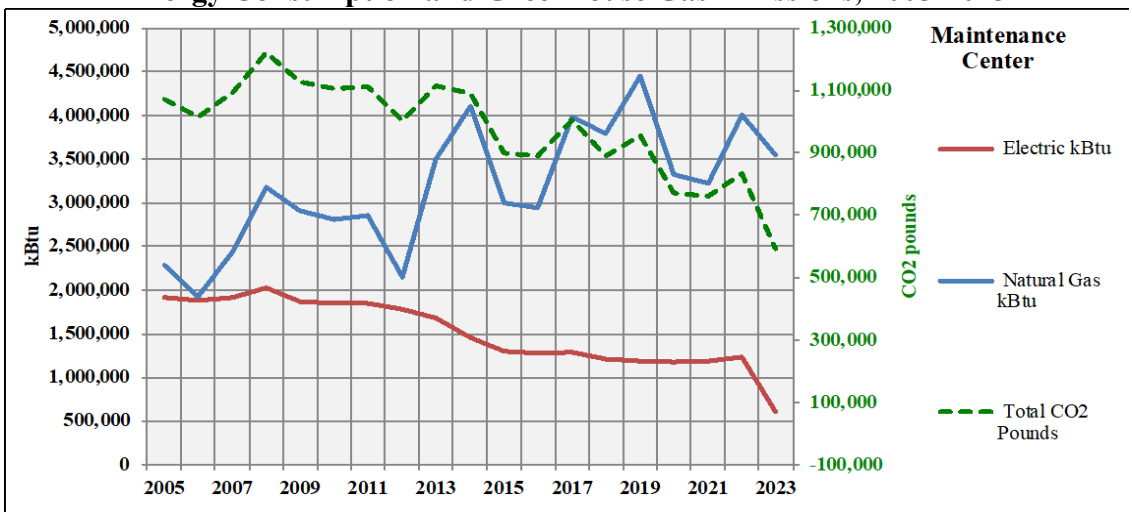
Figure 27: Ice Center, Energy Consumption and Greenhouse Gas Emissions, 2005-2023



The facility was recommissioned in 2017. The average energy use intensity (EUI) was 154 kBtu/sq. ft. from 2005 to 2016. After the recommissioning in 2017, i.e., from 2018 to 2023, it was 215 kBtu/sq. ft., which is 40% larger. The Ice Center facility's natural gas usage has increased, driving up energy usage. The Ice Center's natural gas boilers are 20 years old, and will be replaced in 2025 (estimated). The new boilers will be high-efficiency, at a 96.5% thermal efficiency rating, which will likely cause natural gas usage and cost to decrease. Note that, unlike the other charts for large facilities, Figure 27 shows EUI instead of GHG emissions.

- **Maintenance Center:** Natural gas consumption at the Maintenance Center has fluctuated over time. The very cold winters in 2008, 2013, and 2014 and the heavier-than-average snowfalls in 2011, 2013, 2014, and 2019 account for some of the higher-than-average natural gas consumption during those years. However, gas consumption was down in 2023 in spite of the very heavy snowfall that year. The facility has large heated garages that lose the heat when opened for equipment access. Warm winters with lower-than-average snowfalls in 2012 and 2015-2016 account for some the lower-than-average natural gas consumption during those years. The patrol division of the Police Department operated out of the building when its offices in City Hall were being rehabbed from June 2017 to Feb 2018. It involved a 24/7 operation for their staff, which helps explain the increase in energy consumption in 2017 compared to 2016 (35% larger). All of the parking bays were converted to LED lighting between June 2017 to February 2018. Electricity consumption (kWh) in 2023 was -68% smaller than in 2005. However, overall energy consumption in 2023 (Btu) was 5% higher than in the 2005 Base Year. Greenhouse gas emissions were -45% lower, due to the importance of the reduction in electricity consumption and the declining electricity emission factor. (Figure 28).

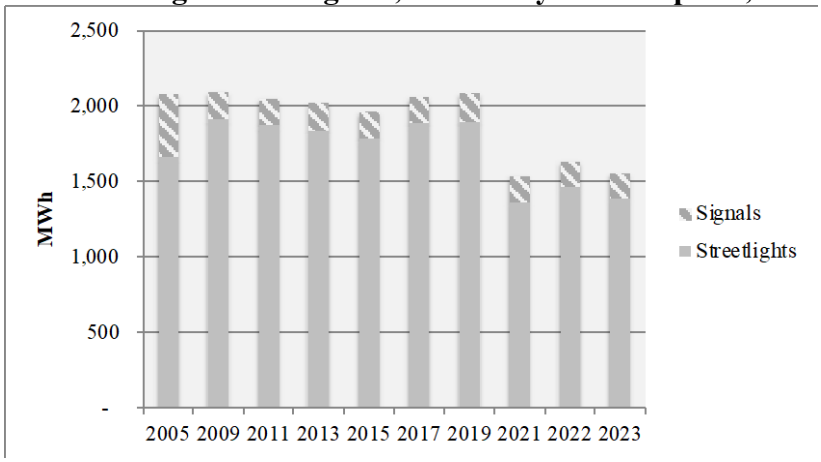
**Figure 28: Maintenance Center,
Energy Consumption and Greenhouse Gas Emissions, 2005-2023**



5. Streetlights and Signals

Since 2013, the City has implemented a program to replace its streetlights and signals with high-efficiency LED bulbs. Facilities that were upgraded included the City Hall/Police Department, the Maintenance Center, the Heart of the City Parking Ramp, and the Parking Deck near the Ames Performing Arts Center.

Figure 29: Streetlights and Signals, Electricity Consumption, 2005-2023



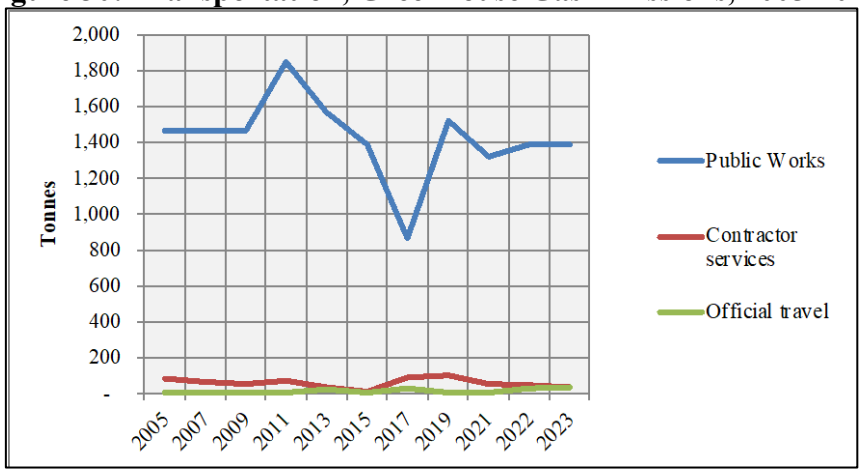
Electricity consumption for streetlights and signals comprised 10% of total electricity consumption in 2023. Even though the system included additional fixtures, consumption was -26% lower in 2023 than in 2005 due to changeouts to LED fixtures. GHG emissions were significantly lower still (-55% lower) because of the reduced electricity emission factors (Figure 29).

6. Transportation

6.1. Liquid Fuel Consumption, Public Works, Fleets, and Contractor Services: Figure 10 lists the fuel consumption managed by the Public Works Department (which includes vehicle fuel consumption by the Police, Fire, and other departments), and private contractors that perform tasks and services that are part of the normal, annual operations of the City and typically funded via the City's General Fund (e.g. snowplowing, street sweeping and seal coating, maintenance for streetlights and public trees, etc.). Excluded from this operational assessment are emissions associated with implementing projects that are included in the City's 5-year Capital Improvement Program. These are projects that are typically very large and funded via municipal bonds.

Emissions from liquid fuels were -8% lower in 2023 than in the 2005 Base Year. Emissions from fuel consumption by Public Works comprised 11% of total City operations emissions in 2023. They were relatively stable during the 15-year Study Period (with the exception of 2011). Emissions associated with contractor services have been relatively small and consistent over the Study Period. They only equaled 3% of total transportation emissions in 2023 and a tiny fraction of overall city operations emissions (Figure 30).

Figure 30: Transportation, Greenhouse Gas Emissions, 2005-2023



6.2. Official Travel: Figure 30 shows that this emission sector accounts for only a very small portion of overall transportation emissions (3% of the total) and a miniscule portion of the total for City operations. The 2013 amount was considerably higher than prior study years. City staff explained that the City enacted severe restrictions on out-of-state travel due to the difficult economic conditions from approximately 2008 through 2011. By 2013, the City had returned to a normal amount of out-of-state travel for training and conferences. This resulted in a much larger number of airline trips and considerably more road miles. Travel in 2015 returned to the much lower levels found in the other study years but jumped up again in 2017 to the highest level recorded at

that time due to 39 airline trips. Emission jumped further still in 2022 and 2023 due primarily to air travel.

7. Potable Water Production

As mentioned above, the wells, pumps, reservoir, and the Water Treatment Plant necessary to produce and distribute potable water were the largest consumers of energy (predominantly electricity) and source of GHG emissions from 2005 through 2019 (Figure 10). From 2007 to 2017, the City invested nearly $19 million in 28 major improvements to the overall system, including the construction of a major addition to the Water Treatment Plant to treat surface water from the Kraemer Quarry, a major rehabilitation of the Water Treatment Plant, and 16 pump replacements.

The *Potable Water Analysis, City of Burnsville* (updated in 2020) concluded that the most significant investment, equaling 55% of the investment total, was for adding and treating the surface water source from the Kraemer Quarry, which began operation in 2009. This surface water source consistently produced water using less energy per gallon than the groundwater system. On average from 2009 to 2019, producing water from the Kraemer Quarry took -37% fewer Btus per gallon than from the wells.

These improvements to the system resulted in most of the GHG reductions that enabled the City to exceed its GHG reduction goals. The following subsections focus on quantifying water production (including sales to other cities), per-capita water consumption, energy consumption and associated GHG emissions, a closer look at the 4 facilities, change over the Study Period, and efficiency measures.

7.1. Water Production: The total amount of pumped water increased generally over the 19-year period from 2.6 billion gallons in 2005 to a high in 2015 of 3.7 billion gallons.[21] The amount in 2023 was 27% higher than in 2005 (Figure 31). In mid-2009, the City completed the surface water facility addition to the Water Treatment Plant (30% larger) and an upgrade to the facility, which resulted in reduced production. The City also significantly increased its sales of water to other communities over the study years, from a tiny amount in 2005 to an average of about 19% of total production since 2011. The table in Figure 32 includes the annual production amounts, energy consumption, and GHG emissions for the water system; and Figure 33 charts that information.

[21] Exceptions to the generally steady increase in water production include 2009 and 2010. In mid-2009, the City completed the surface water facility addition to the Water Treatment Plant and an upgrade to the facility, which resulted in reduced production. Another exception is 2016-2019 when pumping was only 82% as high as in the prior year, 2015.

Figure 31: Water Production, 2005-2023

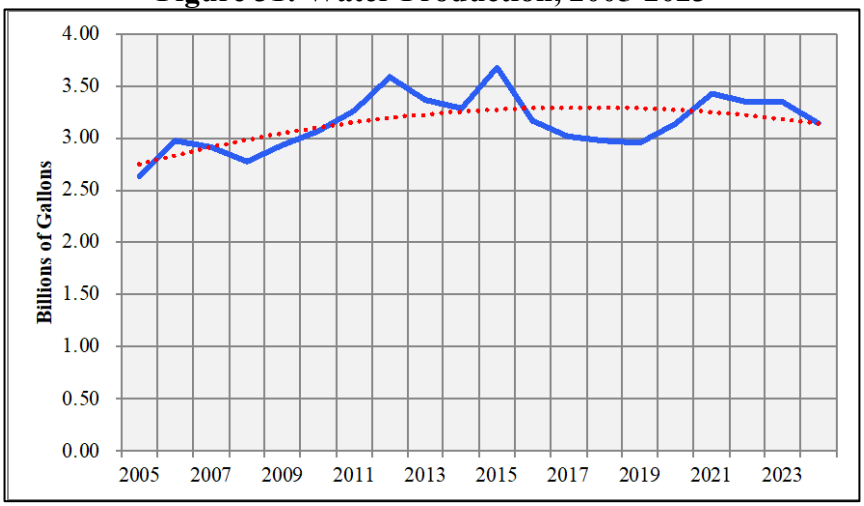


Figure 32: Water Production, Energy Consumption, and Emissions, 2005-2025

Category	2005	2007	2009	2011	2013	2015	2017	2019	2021	2022	2023	Average
Potable water (billions of gal.)	2.63		2.94	3.26	3.36	3.68	3.02	2.95	3.43	3.35	3.35	3.20
Energy efficiency (gal. per kBtu)	42.9		59.5	63.5	78.1	69.6	72.2	78.5	71.6	69.4	79.8	68.5
GHG (tonnes) per million gallons	3.89		2.95	2.29	1.77	2.09	1.84	1.85	1.53	1.57	1.22	2.10
GHG from electricity (tonnes)	9,584		8,399	6,842	5,614	7,134	5,320	5,177	4,642	4,642	3,404	6,076
GHG from natural gas (tonnes)	647		251	629	349	554	232	296	596	628	674	486
Total GHG (tonnes)	10,231		8,650	7,471	5,963	7,688	5,552	5,473	5,238	5,270	4,079	6,561
MMBtu from electricity	49,185		44,614	39,527	36,459	42,352	37,443	33,541	36,665	38,290	30,443	38,852
MMBtu from natural gas	12,216		4,744	11,866	6,580	10,456	4,381	4,088	11,239	9,958	11,491	8,702
Total energy consumption (MMBtu)	61,401		49,358	51,393	43,039	52,808	41,824	37,629	47,903	48,248	41,934	47,554
Water Treatment plan energy efficiency (gal. per kBtu)			168	169	161	166	157	161	166	170	218	171
Nicollet Reservoir energy consumption (kBtu)			11,073,751	15,736,483	11,280,486	11,092,040	7,808,441	7,194,447	8,587,467	8,995,957	7,596,290	9,929,485

7.2. Energy Consumption, Efficiency, and Greenhouse Gas Emissions: The following are the key points from the potable water analysis:

- **Energy consumption and efficiency:** The average energy consumption for the water system over the Study Period was 47,300 MMBtu. It was -34% lower in 2023 than in 2005 despite the production of 27% more water. Measuring energy efficiency can give an accurate picture of energy consumption versus water production. Energy efficiency in the production of potable water (including sales to other cities) increased from 2005 to 2023 on a gallon-per-Btu basis. The same amount of energy produced 92% more water in 2023 than in 2005 (refer to Figure 34).

- **2023 emissions compared to 2005 Base Year:** In 2023, potable water production and distribution continued to account for a large share of emissions from energy consumption (37% of the City total in 2023), as well as the greatest amount of emission reduction from the 2005 Base Year (emissions in 2023 were -60% less than in 2005). If *normalized* on the basis of tonnes-per-million-gallons, emissions were -69% lower in 2023 compared to 2005. Approximately 14% of this reduction was due to lowered electricity emission factors and 86% due to increased efficiency.

Figure 33: Potable Water Production and Energy Consumption, 2005-2023

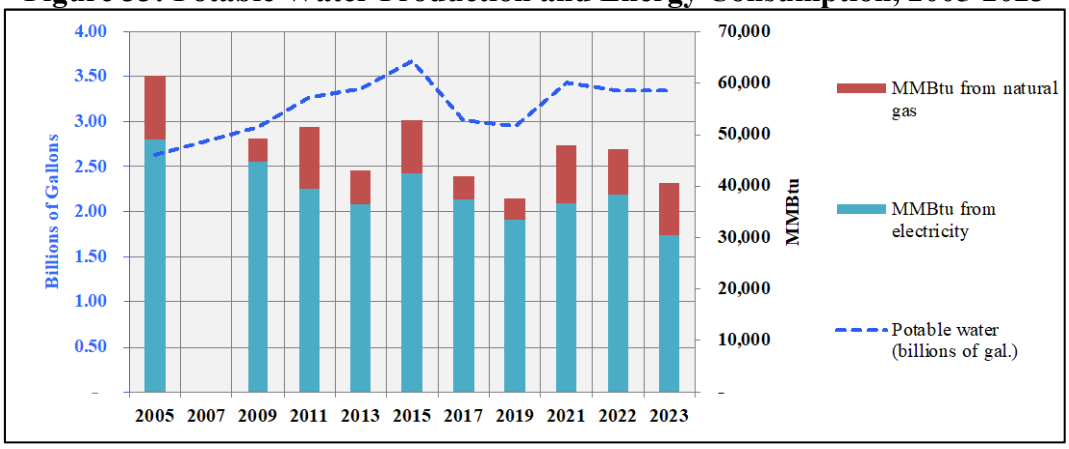
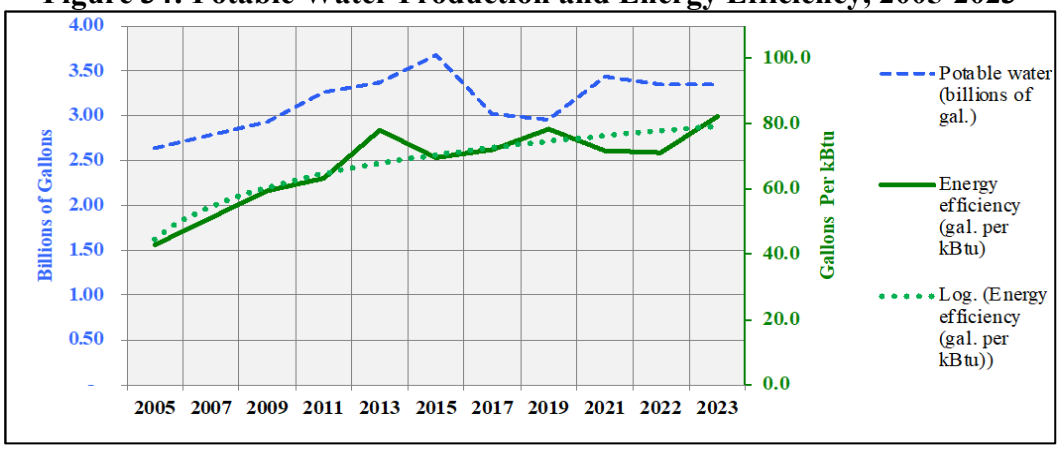


Figure 34: Potable Water Production and Energy Efficiency, 2005-2023



- **Electricity and natural gas consumption, and electrical efficiency:** On average over the Study Period, electricity provided 82% of the needed Btus, and natural gas the remaining 18%. GHG emissions from electricity consumption accounted for 93% of total emissions from water production. As such, it's appropriate to focus on electricity consumption, emissions, and efficiency. The substantial facility upgrades to more efficient pumps and other equipment for the City's system mentioned above resulted in major decreases in electricity consumption per gallon produced compared to 2005 (Figure 36). The Kraemer Quarry pumping station and the City's Water Treatment Plant expansion, which came on line in 2009, enabled it to increase its production of potable water in 2011 by 25% over 2009 levels. Remarkably, the amount of electricity required at the plant actually decreased.

  Total electricity consumption declined from 2005 to 2013 while water production increased (Figure 35). After a jump in energy consumption in 2015 at the Water Treatment Plant and Nicollet Reservoir, which corresponded to an increase in water production, total electricity consumption declined in 2019, then increased somewhat in 2021, and then declined again in 2023. Total electricity consumption in 2023 was -20% lower than in 2005 (Figure 35).

Electricity efficiency for the production of potable water (gal. per kWh) steadily climbed from 2005 to 2013 when it was 72% higher than in 2005 (Figure 36). This coincided with decreases in electricity consumption at the Water Treatment Plant, City wells, and to a lesser extent, the Nicollet Reservoir even as water production increased over that period (Figure 36). Efficiency dropped in 2017 and 2019 since water production decreased significantly (it was an average of -18% lower than in 2013); however, the drop in electricity consumption did not match it, probably due to fixed consumption requirements that are unrelated to variable production levels (e.g., building HVAC demands). Water production increased again in 2021 and electricity efficiency peaked in that year at 75% higher than in 2005. Electrical efficiency went even higher in 2023. It was 101% higher than in 2005 (Figure 31 and 36).

Figure 35: Potable Water Production and Electricity Consumption, 2005-2023

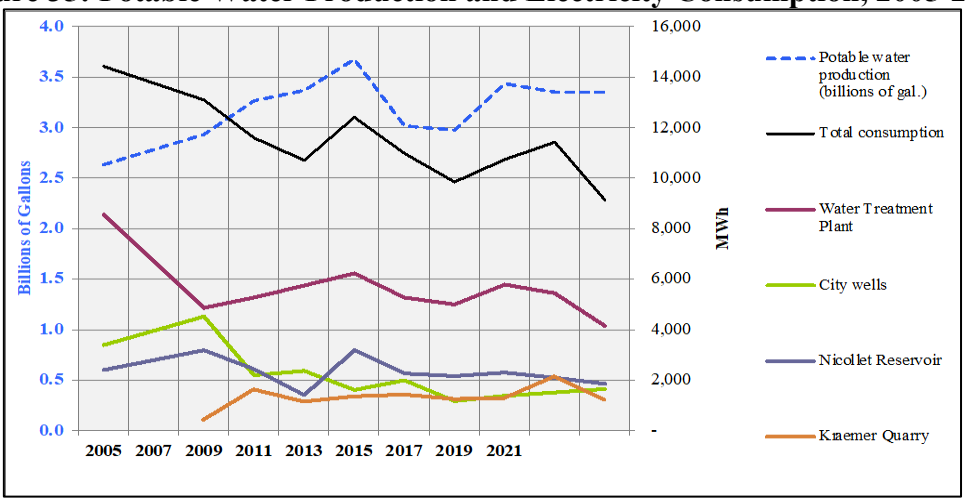
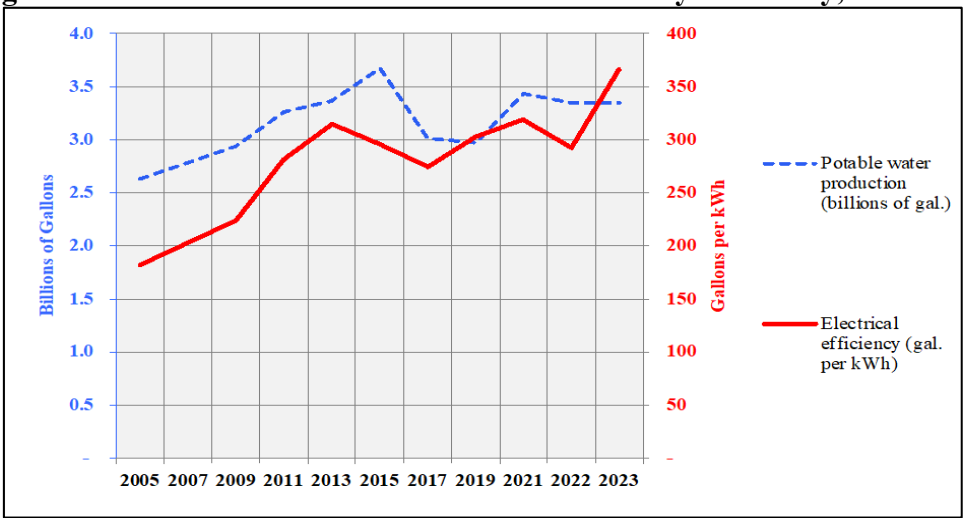


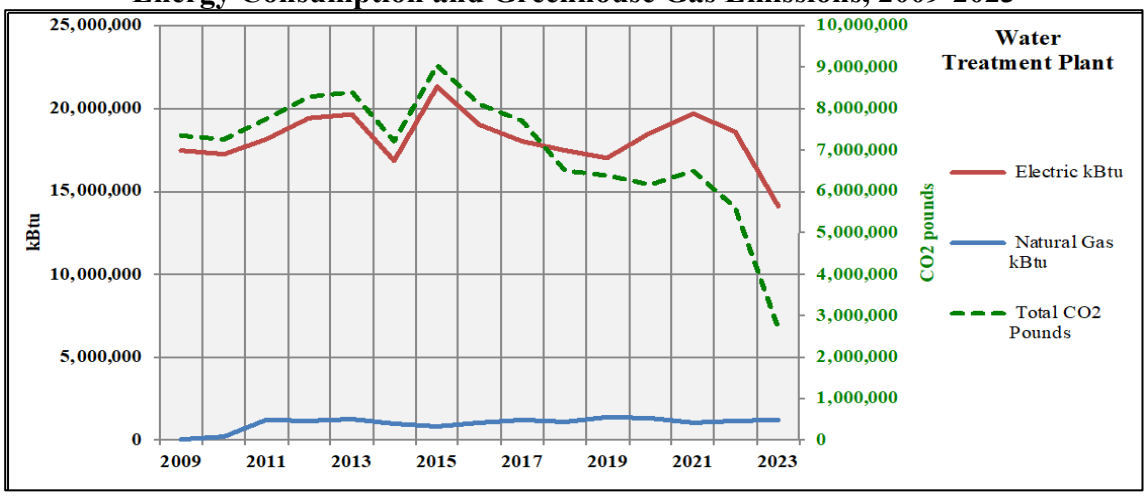
Figure 36: Potable Water Production and Electricity Efficiency, 2005-2023



7.3. Water Treatment Plant: The Water Treatment Plant, which began operation in 2009, relies primarily on electricity. Consumption was steady until a drop in 2014 (-14% lower than 2013), then a jump in 2015 (26% higher than in 2014), then declines again in 2016 and 2017, and increases in 2019 and 2021 (Figure 37). Overall energy consumption was 18% higher in 2021 than in 2009. Overall energy consumption was -12% lower in 2023 than in 2009.

Electricity consumption at the Plant was -5% lower in 2017 compared to 2016 because a rehabilitation project in October 2017 required substantial bypassing of the filters. The project forced a reduction of the water sent to the City of Savage and an overall drop of -18% in total gallons produced compared to 2015. The City relied on more pumping from deep wells that require more electricity per gallon. As a result, overall energy efficiency for the production of potable water was 4% higher in 2019 compared to 2015 in terms of gallons-per-Btu produced.

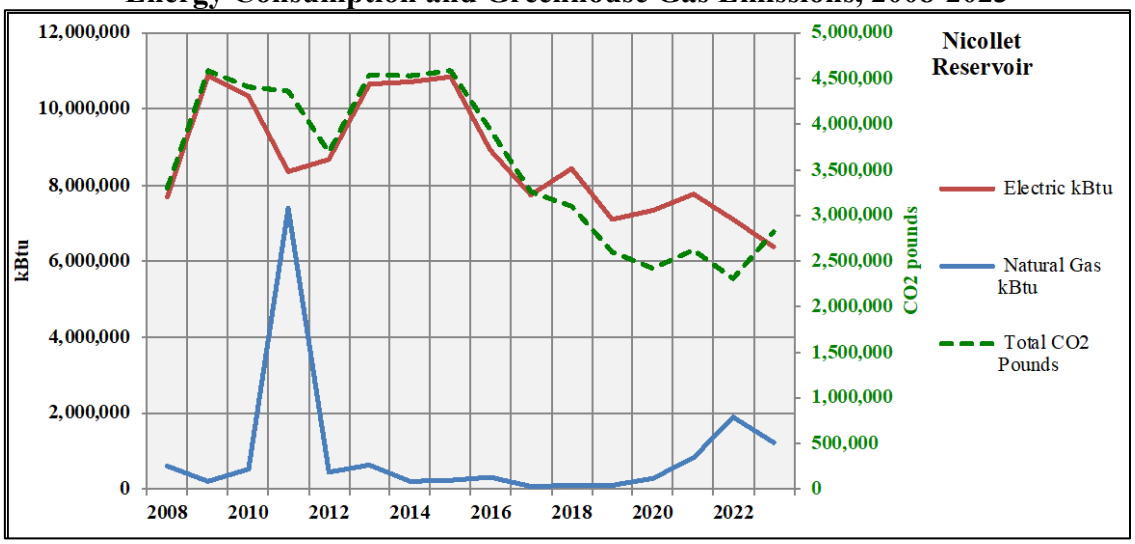
Figure 37: Water Treatment Plant, Energy Consumption and Greenhouse Gas Emissions, 2009-2023



7.4. Nicollet Reservoir: The Nicollet Reservoir relies primarily on electricity to drive its pumps; however, it has a backup system powered by natural gas. Electrical system changeouts in 2010 account for the large spike in natural gas usage that year (13 times higher compared to 2009). As a result, more energy was used, 49% more than in 2013 and it was more costly (9% more than in 2013) per gallon pumped.[22] Energy consumption in 2023 was -8% lower than in the 2008 Base Year, the facility's first year of full operation (Figure 38).

[22] The point about the cost is based on the findings from the *Potable Water Analysis, City of Burnsville*

Figure 38: Nicollet Reservoir,
Energy Consumption and Greenhouse Gas Emissions, 2008-2023



7.5. The Importance of Electricity: Several factors described in the *Potable Water Analysis, City of Burnsville* emphasized the importance of maximizing energy efficiency throughout the system, and especially electrical efficiency:

- The cost of electricity (dollars per kWh) increased by 31% between 2005 and 2019 when the study was updated.
- In 2019, 89% of the energy for the potable water system came from electricity and the remainder from natural gas (77% in 2021).
- Between 2005 and 2019, the system increasingly relied on electricity rather than natural gas (9% greater reliance in 2019 than in 2005).
- Continued energy cost increases and energy efficiency measures in the future would shorten the payback period considerably for the investments.

8. Scope 3 Emissions

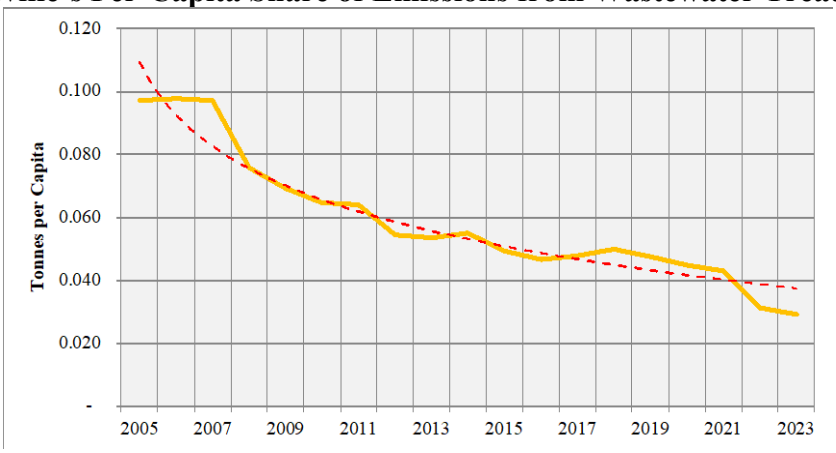
8.1. Solid Waste Management: Full-time employee (FTE) emissions associated with managing municipal solid waste in Dakota County are used to estimate emissions for City operations. Greenhouse gas emissions were -25% lower in 2023 compared to the 2005 Base Year, primarily because the portion of the waste stream in Dakota County that was landfilled decreased and the portion that was recycled increased by 20%.

8.2. Wastewater Treatment: Figure 2 lists the Scope 3 emissions[23] for wastewater treatment. According to the ICLEI Protocol, these emissions are not to be counted with Scope 1 and 2 emissions but should be reported separately. The City's share of emissions from the regional treatment facility were -68% lower in 2023 than in 2005. On a per-capita and per-household basis, flows were -70% and -70% respectively lower in 2023 than in 2005, due primarily to efficiency improvements within the regional treatment facilities, and the reduced electricity emissions factor (Figures 39 and 40).

Figure 39: Wastewater Emissions, 2005-2023

Emission Scope	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Change from 2005
Scope 1				894	826	816	836	755	745	849	849	818	901	780	889	841	764			
Scope 2				3,743	3,401	3,083	2,982	2,569	2,534	2,552	2,205	2,064	2,070	2,347	2,103	2,047	2,006			
Total	5,962	5,962	5,962	4,637	4,228	3,899	3,818	3,325	3,279	3,401	3,054	2,882	2,971	3,127	2,992	2,888	2,770	2,025	1,897	-68%
Per-capita	0.097	0.098	0.097	0.076	0.069	0.065	0.064	0.054	0.053	0.055	0.049	0.047	0.048	0.050	0.048	0.045	0.043	0.031	0.029	-70%
Per-household	0.245	0.244	0.242	0.188	0.171	0.158	0.157	0.139	0.133	0.137	0.122	0.115	0.118	0.124	0.118	0.114	0.109	0.078	0.073	-70%
Notes:																				
1	Source: Metropolitan Council Environmental Services, David Ponder, David.Ponder@metc.state.mn.us. https://metrocouncil.org/Data-and-Maps/Research-and-Data/Research-by-topic.aspx																			
2	Figures for 2021-23 are based on linear regression from known data.																			

Figure 40: Burnsville's Per-Capita Share of Emissions from Wastewater Treatment, 2005-2023



[23] For a description of the differences among the 3 Scopes for this Assessment, refer to Section 1.2.

Attachment A

Detailed Summary, Burnsville City Operations Greenhouse Gas Assessment, 2005-2023

City Operations Emissions	2005		2009		2011		2013		2015		2017		2019		2021		2022		2023		GHG Change from 2005
	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	GHG Emissions (tonnes)	% of Subtotal	
Scope 1 and 2 Emissions																					
Buildings and Facilities:	**5,060**	27%	**5,626**	32%	**5,424**	33%	**4,542**	33%	**5,535**	34%	**4,943**	38%	**5,123**	37%	**4,983**	40%	**5,316**	40%	**4,467**	41%	-12%
Buildings (incl. on-site lighting, emergency generators, and sirens)	2,441	13%	3,211	18%	3,114	19%	3,014	22%	2,855	18%	2,523	19%	2,886	21%	2,802	22%	3,168	24%	2,709	25%	11%
Park and Recreation facilities	2,619	14%	2,415	14%	2,310	14%	1,528	11%	2,680	16%	2,421	19%	2,237	16%	2,181	17%	2,148	16%	1,758	16%	-33%
Streetlights, Signals, and Signs:	**1,757**	9%	**1,621**	9%	**1,515**	9%	**1,416**	10%	**1,473**	9%	**1,359**	10%	**1,503**	11%	**797**	7%	**1,008**	8%	**797**	7%	-55%
Streetlights	1,400	7%	1,475	8%	1,390	8%	1,293	9%	1,342	8%	1,246	10%	1,383	10%	913	7%	913	7%	717	7%	-49%
Signals and Signs	357	2%	146	1%	125	1%	123	1%	131	1%	113	1%	119	1%	98	1%	95	1%	80	1%	-78%
Water and Sewer Department:	**10,363**	55%	**8,767**	50%	**7,619**	46%	**6,114**	45%	**7,887**	48%	**5,725**	44%	**5,660**	41%	**5,380**	38%	**5,412**	41%	**4,201**	38%	-59%
Potable water	10,231	55%	8,650	49%	7,471	45%	5,963	44%	7,688	47%	5,552	43%	5,473	39%	5,238	42%	5,270	40%	4,079	37%	-60%
Sanitary sewers (energy consumption)	132	1%	117	1%	149	1%	152	1%	200	1%	174	1%	188	1%	143	1%	142	1%	123	1%	-7%
Transportation:	**1,556**	8%	**1,530**	9%	**1,927**	12%	**1,629**	12%	**1,403**	9%	**986**	8%	**1,630**	12%	**1,378**	11%	**1,467**	11%	**1,460**	13%	-6%
Public Works and fleets	1,470	8%	1,471	8%	1,852	11%	1,570	11%	1,390	9%	864	7%	1,520	11%	1,321	11%	1,389	11%	1,387	13%	-6%
Contractor services	81	0.4%	54	0.3%	70	0.4%	33	0.2%	9	0.1%	93	0.7%	102	0.7%	54	0.4%	47	0.4%	37	0.3%	-54%
Official travel	5	0.03%	5	0.03%	5	0.03%	25	0.18%	3	0.02%	29	0.22%	8	0.05%	3	0.02%	31	0.24%	36	0.33%	571%
Subtotal GHG Emissions:	18,736	100%	17,545	100%	16,486	100%	13,701	100%	16,298	100%	13,013	100%	13,916	100%	12,538	100%	13,203	100%	10,926	100%	-42%
Percent reduction from 2005 Base Year			-6%		-12%		-27%		-13%		-31%		-26%		-33%		-30%		-42%		-42%
Renewable Energy Certificates (RECs) [1]																	-4,576		-3,598		
Total Scope 1 & 2 GHG Emissions	18,736		17,545		16,486		13,701		16,298		13,013		13,916		12,538		8,627		7,327		-61%
Normalizing Factors:																					
Normalized for electricity emission factors (excluding RECs) [2]	18,736		18,132		17,930		15,723		17,790		16,176		16,610		15,858		17,367		15,628		-17%
Per-FTE GHG (incl. RECs)	67.6		54.0		52.4		44.4		60.1		46.5		47.5		43.3		29.7		23.7		-65%
Per-capita GHG (incl. RECs)	0.31		0.29		0.28		0.22		0.26		0.21		0.22		0.19		0.13		0.11		-63%
Per household GHG (incl. RECs)	0.77		0.71		0.69		0.55		0.65		0.52		0.55		0.49		0.33		0.28		-63%
Total GHG (excluding potable water and RECs)	8,505		8,895		9,015		7,739		8,610		7,462		8,443		7,300		7,933		6,847		-19%
Scope 3 Emissions																					
Solid Waste Management	107	2%	97	2%	98	3%	88	3%	77	2%	83	3%	89	3%	106	4%	94	4%	101	5%	-6%
Sanitary sewer treatment	5,962	98%	4,228	98%	3,818	97%	3,279	97%	3,054	98%	2,971	97%	2,992	97%	2,770	96%	2,025	96%	1,897	95%	-68%
Total Scope 3 GHG Emissions	6,069	100%	4,325	100%	3,916	100%	3,367	100%	3,131	100%	3,054	100%	3,081	100%	2,876	100%	2,118	100%	1,998	100%	-67%
Other Factors:																					
City employees (FTE)	277		325		315		309		271		280		293		290		291		310		12%
City population	61,262		61,047		59,565		61,300		61,908		62,239		62,785		64,420		64,522		64,653		6%
City households	24,380		24,723		23,843		24,854		24,990		25,252		25,405		25,657		25,834		25,904		6%
Blended electricity emission factor (GHG tonnes per MWh)	0.737		0.708		0.671		0.612		0.667		0.579		0.599		0.548		0.516		0.460		-38%
Weather summary	Hot and wet summer, low heating degree days (HDD)		Normal cooling degree days (CDD) but very dry summer with normal HDD		Very hot and dry summer, normal HDD and very heavy snowfall		Hot summer, higher HDD and heavy snowfall		Hot and wet summer with low HDD and low snowfall		Hot and very wet summer with low HDD and very low snowfall		Normal winter temp, very heavy snowfall, warm and wet summer		Cooler winter, light snowfall, very hot summer drought		Cooler winter, light snowfall, very hot summer, drought		Warmer winter, very heavy snowfall, very hot summer, drought		

Notes:

1 Renewable Energy Certificates (RECs) are issued for each megawatt-hour of renewable electricity added to the grid. They serve as an accounting tool for renewable energy in the mixed-source power grid. RECs represent the environmental benefits of renewable energy, thus, no GHG emissions are associated with them per the ICLEI Protocol.

2 In order to get a more accurate picture of performance, it is valuable to screen out factors that affect emissions but are beyond the control of the City. The electricity-normalized figures show the emissions that would have been emitted had the electric utilities not reduced their emission rates below their 2005 levels.