City of Denton

Greenhouse Gas Inventory: 2017

Summary Report

Sustainability

May 2018

Welcome to the City of Denton's 2017 Greenhouse Gas Inventory.

The City is committed to improving quality of life, protecting the environment, and creating economic opportunities for its citizens, businesses and institutions. Air Quality and Greenhouse Gas Management is a key focus area of Denton's sustainability plan, *Simply Sustainable*, *A Strategic Plan for Denton's Future*, adopted in February 2012. By working to reduce greenhouse gas emissions, the City can achieve multiple benefits, including saving energy and money, strengthening the local economy, improving local air quality, and preserving quality of life in our community.

In 2005, the City of Denton signed the U.S. Conference of Mayors Climate Protection Agreement and joined other cities nationwide in collecting data and taking steps to identify and reduce greenhouse gas (GHG) emissions.

Tracking greenhouse gas emissions supports policies and actions that can most effectively reduce emissions while also achieving other City goals.

This report presents the GHG emissions inventoried from municipal operations as well as from activities of the community as a whole for **fiscal year 2017 (October 2016 – September 2017).** The community inventory includes emissions generated from municipal operations. Consistent with recommended protocols, both the municipal and community inventories include Scope 1 (direct emissions from combustion or organic material decomposition) and Scope 2 (indirect emissions over which an entity has direct control, such as electricity consumption). Scope 3 (out of direct control of an entity) emissions are considered optional for reporting. Those Scope 3 emissions included here are for informational purposes, and are excluded from GHG emission totals.

Starting in 2015 the City of Denton committed to completing GHG inventories every year in order to accelerate its ability to support positive results and correct negative trends. Prior to this, reports were completed approximately every five years. Inventory reports for previous years can be found at www.sustainabledenton.com.

Greenhouse Gas Emissions: The Basics

Naturally occurring gases, called greenhouse gases (GHGs), help regulate the temperature of our planet in a phenomenon referred to as "the greenhouse effect." Modern human activities including the burning of fossil fuels, use of aerosols, clearing of land, and generation of solid waste, have increased greenhouse gases in the atmosphere.

"Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer) (USEPA-4)."

Over the past few decades, scientific and political concern has increased about the potential contribution of human-sourced GHG emissions to climate change. Potential outcomes include global warming and the associated environmental, economic, and social impacts. Expected human health impacts from global climate change include increased: heat-related illnesses, dangers from severe weather events, incidence of vector-borne disease, and illness associated with rising concentration of air and water pollutants.

"**Global warming** is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns (USEPA-4)." Climate change and global warming can be caused by natural processes or human activities.

Climate science is highly complex, and the state of knowledge about climate change is constantly evolving. The most widely cited source on the science of climate change is the Intergovernmental Panel on Climate Change (IPCC- http://www.ipcc.ch/). This international scientific body comprehensively reviews the scientific literature on climate change and publishes summaries of the latest findings. Due to the scope and complexity of their investigation, reports take six years to publish, with the most recent report (Fifth Assessment Report, AR5) published in 2014.

According to the IPCC:

1. "Warming of the climate system is unequivocal;"[1] and
2. "The IPCC is now 95 % certain that humans are the main cause of current global warming."[2]

Additional information on GHG emissions and global climate change, including expected impacts, can be found on the following websites:

- National Oceanic and Atmospheric Administration (NOAA): http://www.noaa.gov; or http://www.climate.gov/
- National Research Council of the National Academies, Climate Change and the National Academies: http://nas-sites.org/americasclimatechoices/
- Intergovernmental Panel on Climate Change (IPCC): http://www.ipcc.ch/

Software for Tracking Greenhouse Gas Emissions: ClearPath

Since 2006, the City has utilized software developed and endorsed by ICLEI Local Governments for Sustainability (ICLEI) and partners including the National Association of Clean Air Agencies (NACAA) and the U.S. Environmental Protection Agency (USEPA). The software has been updated over time to reflect current scientific understanding and to remain consistent with the latest inventory protocols. Since 2011, the City has used ICLEI's web-based ClearPath software,

1 IPCC AR5, SPM p 4
2 IPCC AR5, SR p v

which allows for efficient protocol updates, technical support, and improved forecasting and planning strategies.

Data pertaining to energy use, fuel consumption, and waste is gathered from City departments, community agencies, and service providers and entered into the software to generate GHG inventories for both municipal operations and for the community activities. The software uses the latest methods and emission factors to translate this data into equivalent CO_2 emissions. Equivalent CO_2, abbreviated as CO_2e, is the amount of CO_2 that would have the same, or equivalent, global warming potential as the actual mix of GHG emissions produced (e.g. CO_2, CH_4, N_2O, Fluorinated gases, etc.). The software is a tool for tracking GHG emissions; however, it is useful to think of the numbers generated as an estimate rather than an exact value.

Updates for the 2017 Inventory:

Denton uses data and calculations specific to our city where possible, and seeks to apply these methods consistently over time. As the state of knowledge about climate change evolves, so do the protocols and methods for tracking emissions. This report reflects current GHG inventory protocols, as well as any pertinent updates and refinement of internal tracking methods, including:

- An opportunity to reconcile Denton Municipal Electric (DME) electricity purchases for the 2015 and 2016 GHG Inventory years was made to improve data accuracy. Previously reported data in these categories was based on estimated figures, whereas adjusted data is now based on actuals. Changes to previously reported GHG Inventories are now represented in this report.
- Emission factors for electricity consumption were updated to reflect changes in regional energy sources and their associated GHG levels.
- Emission factors for vehicle transportation were updated to reflect changes in regional and national modeling.
- Summary charts were consolidated to include T&D Loses within the Electricity Emissions category for ease of interpretation. The full breakout out emissions by source can still be found in the Appendix section.

Municipal Operations

Figure 1 summarizes the total annual GHG emissions in metric tons of Carbon Dioxide equivalents (CO_2e) from City of Denton municipal operations for each of our recorded inventory years. We report values using IPCC's 5th Assessment guidelines.

Figure 2 shows how these emissions from municipal operations break down as a metric of Denton's population so we can compare against other cities with similar serviceability. Considering the high rate of population growth in North Texas, a per capita metric is also

important to incorporate into our internal comparative analysis to see how we are performing as a percentage of our resident base.

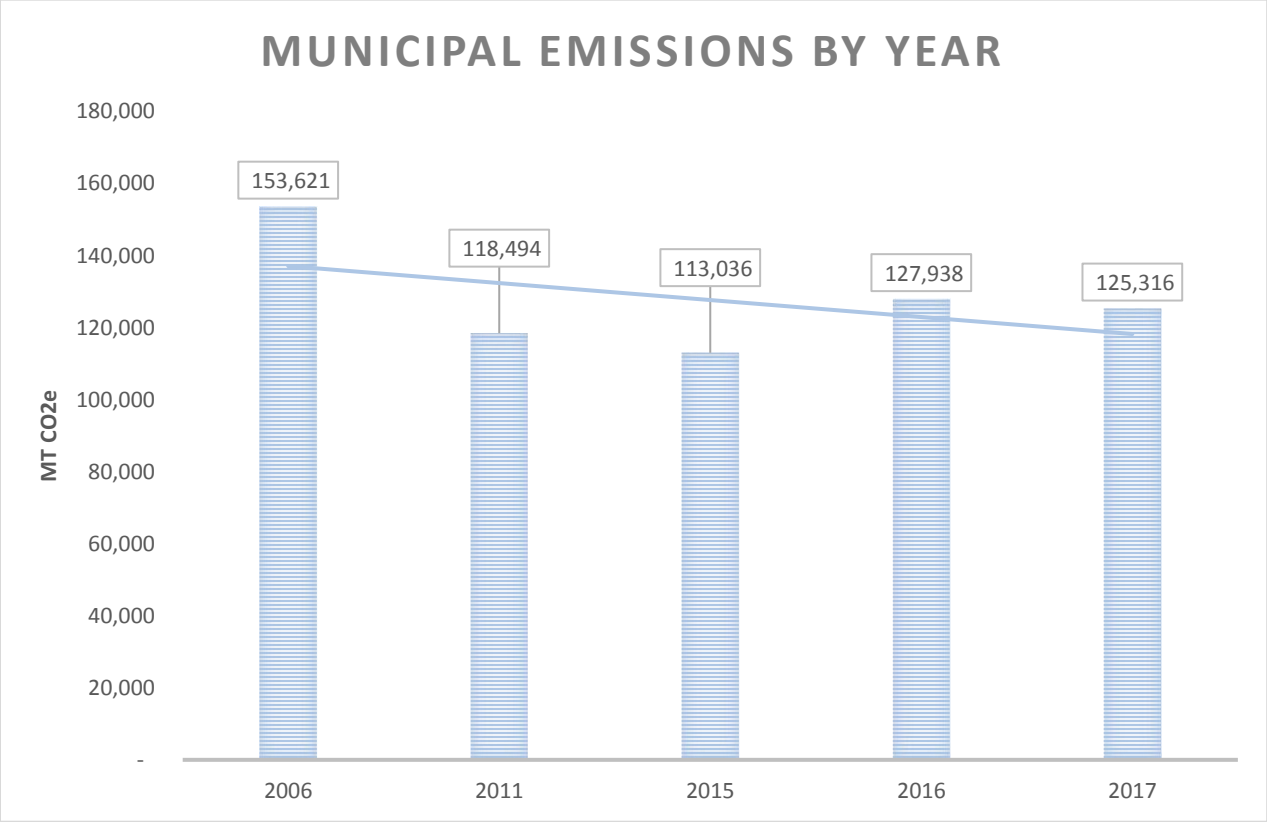

Figure 1

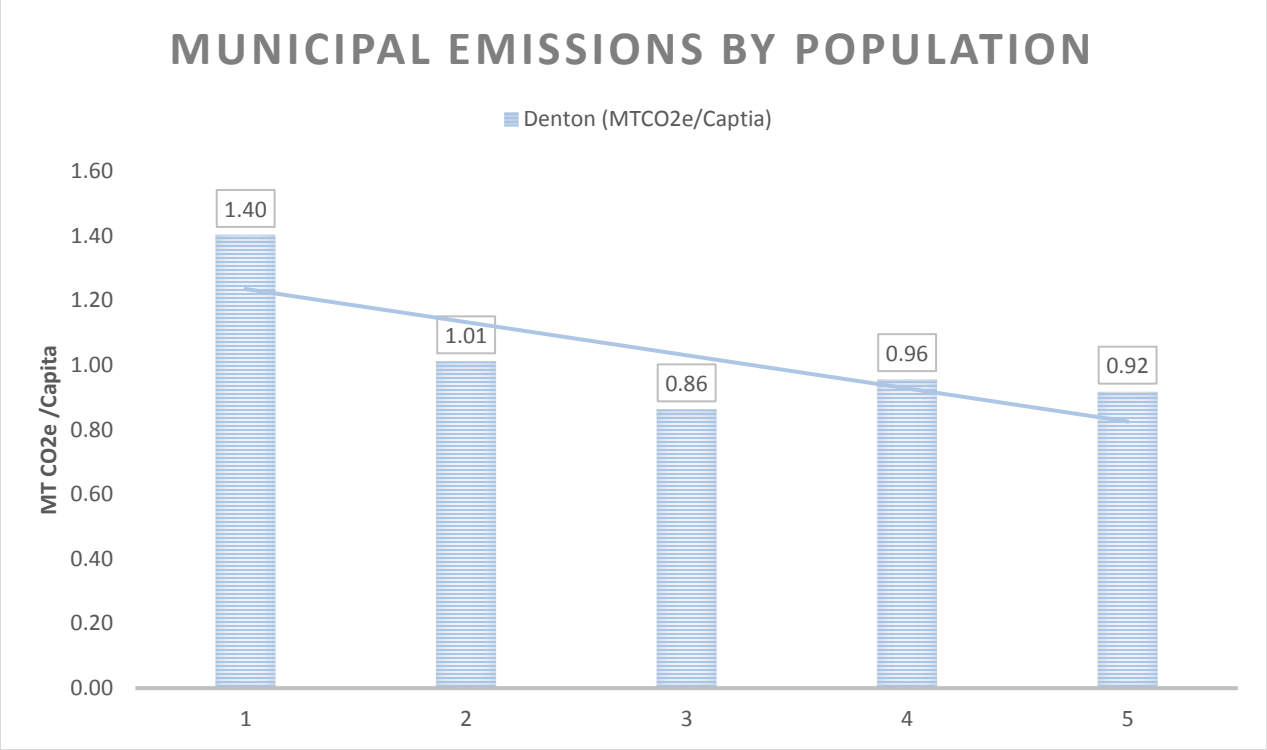

Figure 2

Figure 3 shows how emissions from municipal operations are distributed by source type. These sources include methane emissions from solid and liquid waste decomposition, electricity and natural gas emissions from direct consumption, transportation emissions, and transmission & distribution losses from our municipal utility operations. Understanding where GHG emissions are coming from helps the City determine areas to focus future policy and improvement projects to achieve long term GHG reduction goals.

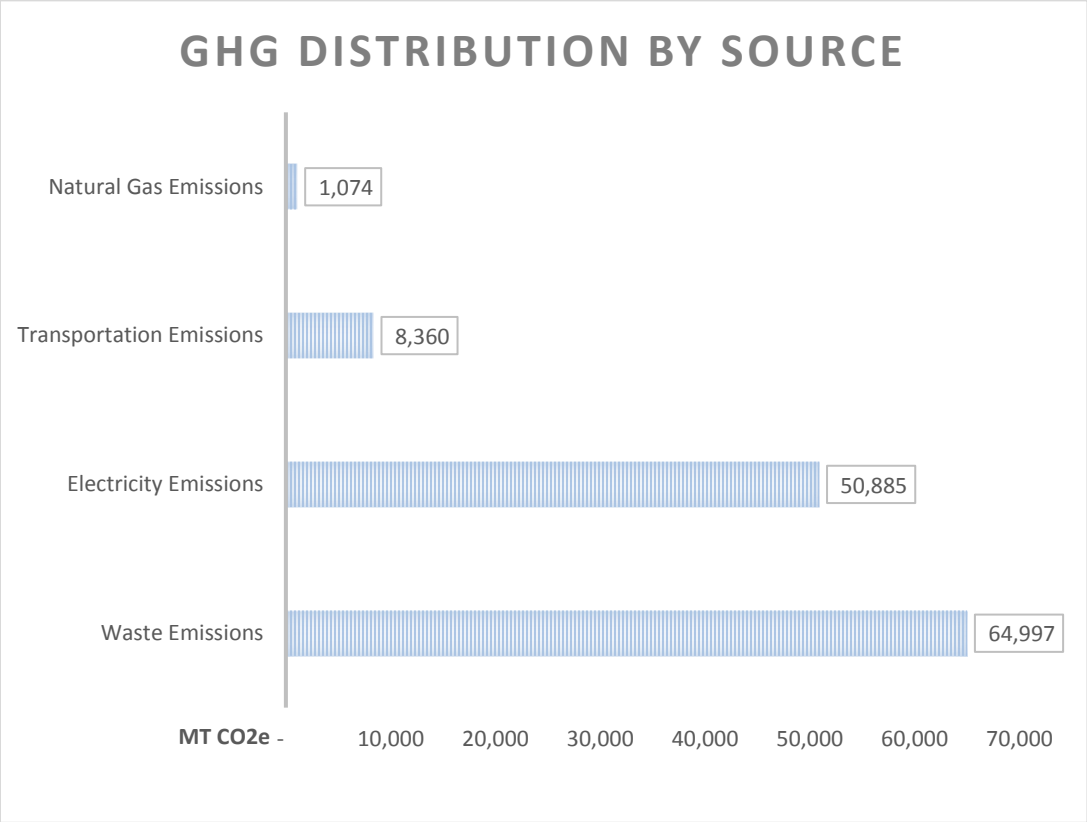

Figure 3 (for a more detailed breakdown of sources, please refer to the Appendix)

Observing long term trends in each of these source categories is an important component of our ongoing reporting and tracking efforts. The City continues to implement new programs and procedures that are helping to reduce our carbon footprint, so it is valuable to see how those efforts translate into tangible GHG reductions. To get a better sense of how each emission source is trending since our baseline year of 2006, **Figure 4** breaks down these changes year over year, while **Figure 5** shows the percentage changes over the base year. For an annual comparison, **Figure 6** shows the percentage changes over the previous Inventory year.

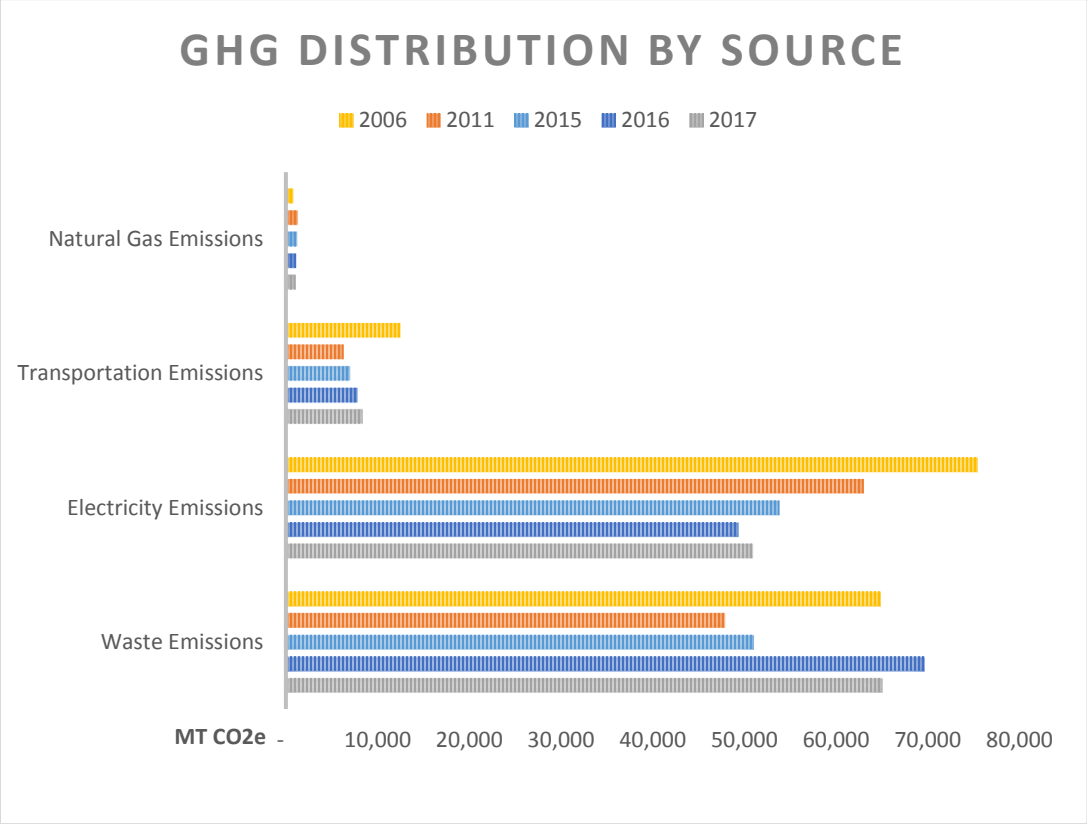

Figure 4

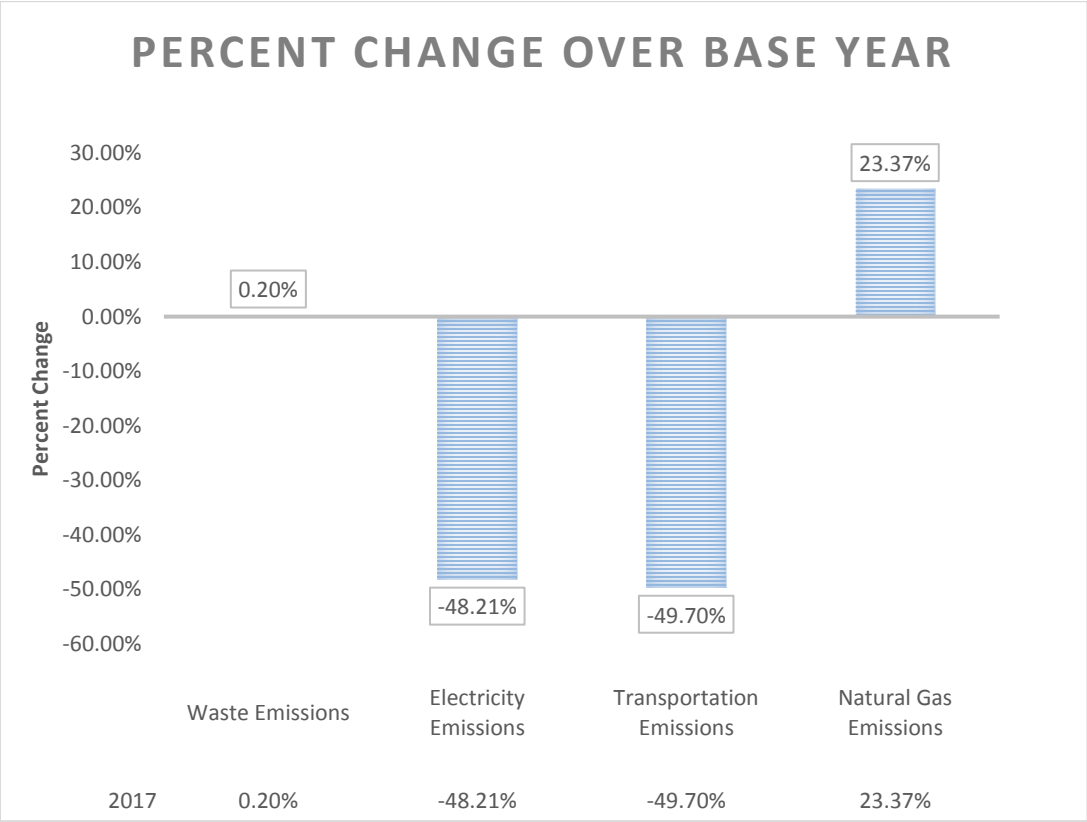

Figure 5

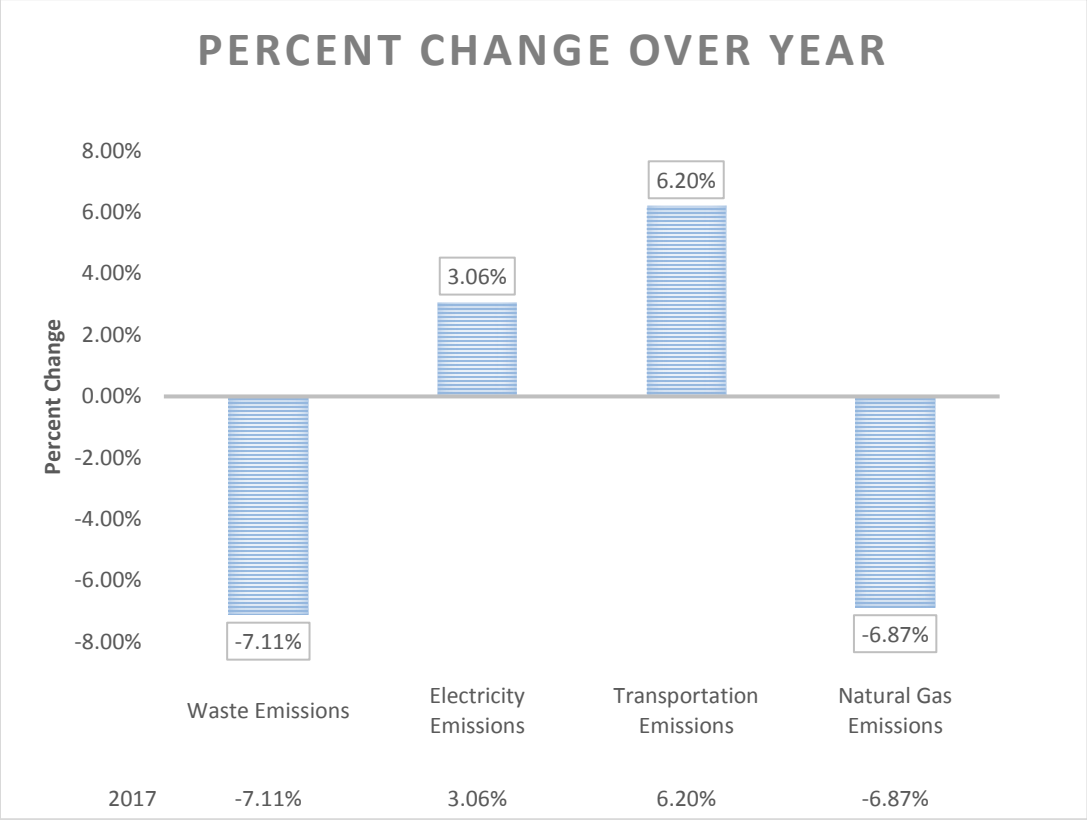

Figure 6

Municipal-Scale Summary:

The following highlights represent any major changes or trends in Denton's municipal scale GHG inventory for the year:

- Overall, the City of Denton has successfully decreased total GHG emissions by more than 23% since 2006, the base year of reporting. During that same time, we have also decreased total GHG emissions per capita by 53%;
- Electricity consumption for municipal operations continues to move in the right direction, decreasing by nearly 3% compared to 2016. Total emissions for the electricity section however observed an increase of 3% due to an increase in the emission factors of electricity, as well as a small increase in T&D Losses;
- Emissions from natural gas, which are almost exclusively attributed to the heating and cooling of municipal buildings, continues on its downward trend since 2011. Operational and mechanical efficiencies implemented by the Facilities Management department are the leading indicator for these improvements;
- An increase in diesel and biodiesel fuel consumption, compounded by an increase in the emission factors of these fuels, are the leading reasons for an emissions increase in the transportation sector compared to 2016. The highest increases were observed in utility related services, which can mostly be attributed to rising population and development.

Though a trend of increasing emissions from the municipal fleet continues, an overall emissions reduction of nearly 50% has been achieved since 2006; and

- After observing an increase in waste emissions last year, there was a 7% decrease in 2017. Considering that overall tonnage of disposed waste increased by 7% during this time period, the most likely reason for the total emissions decreasing is that the contractor who operates the gas-to-energy generator ran the system more efficiently and with less downtime.

Moving Forward:

The following strategies will maximize our work to reduce GHG emissions from municipal operations:

- Continued increase of renewable energy resources in DME's fuel mix;
- Continued energy tracking and targeted efficiency projects, including retrofits and new construction, at municipal buildings and water and wastewater operations;
- Continued efforts to promote community recycling and reduce organics disposal at the landfill; and
- Continued improvement of fleet efficiency, including increased percentage of low/no emissions vehicles and idle reduction education.

Community Activities

Figure 7 summarizes the total annual GHG emissions in metric tons of Carbon Dioxide equivalents (CO_2e) for the entire Denton community, including municipal operations, over reporting years. **Figure 8** highlights how the Denton community compares to the national average when observing GHG emissions on a per capita basis.

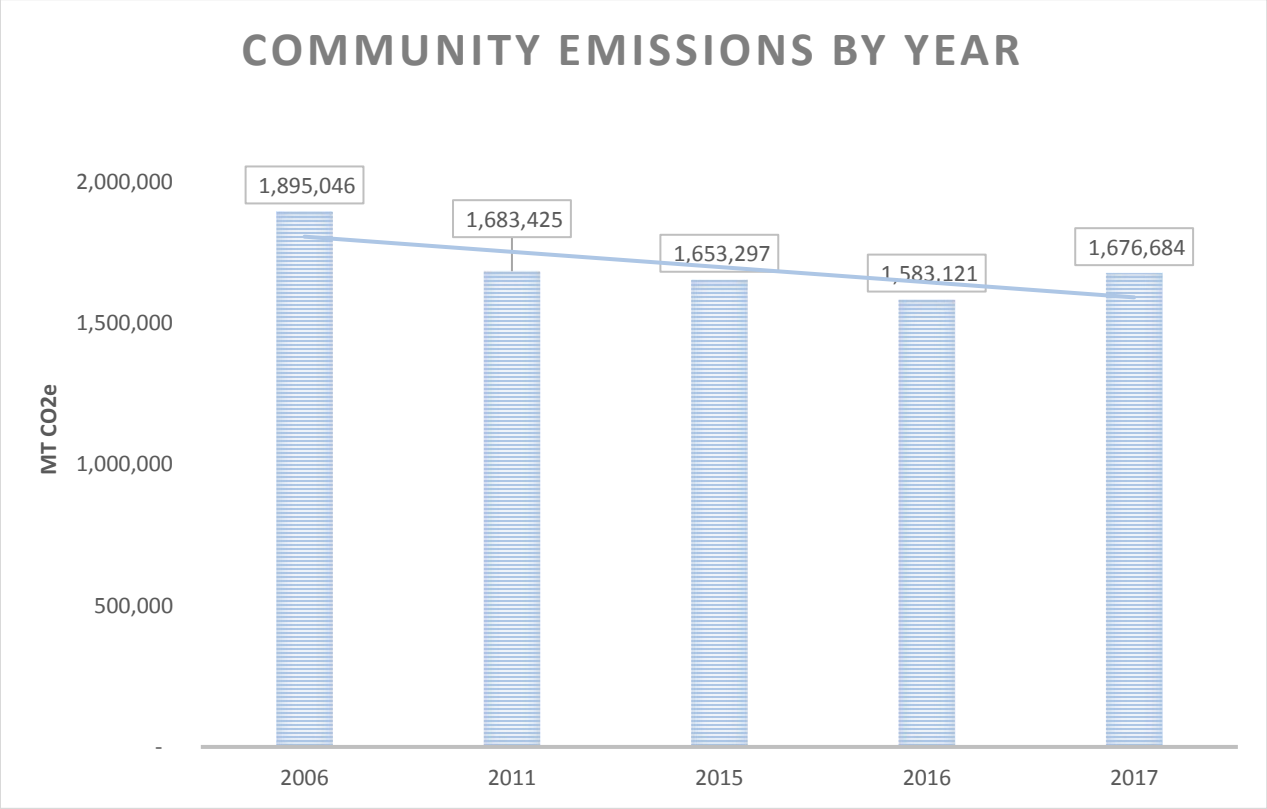

Figure 7

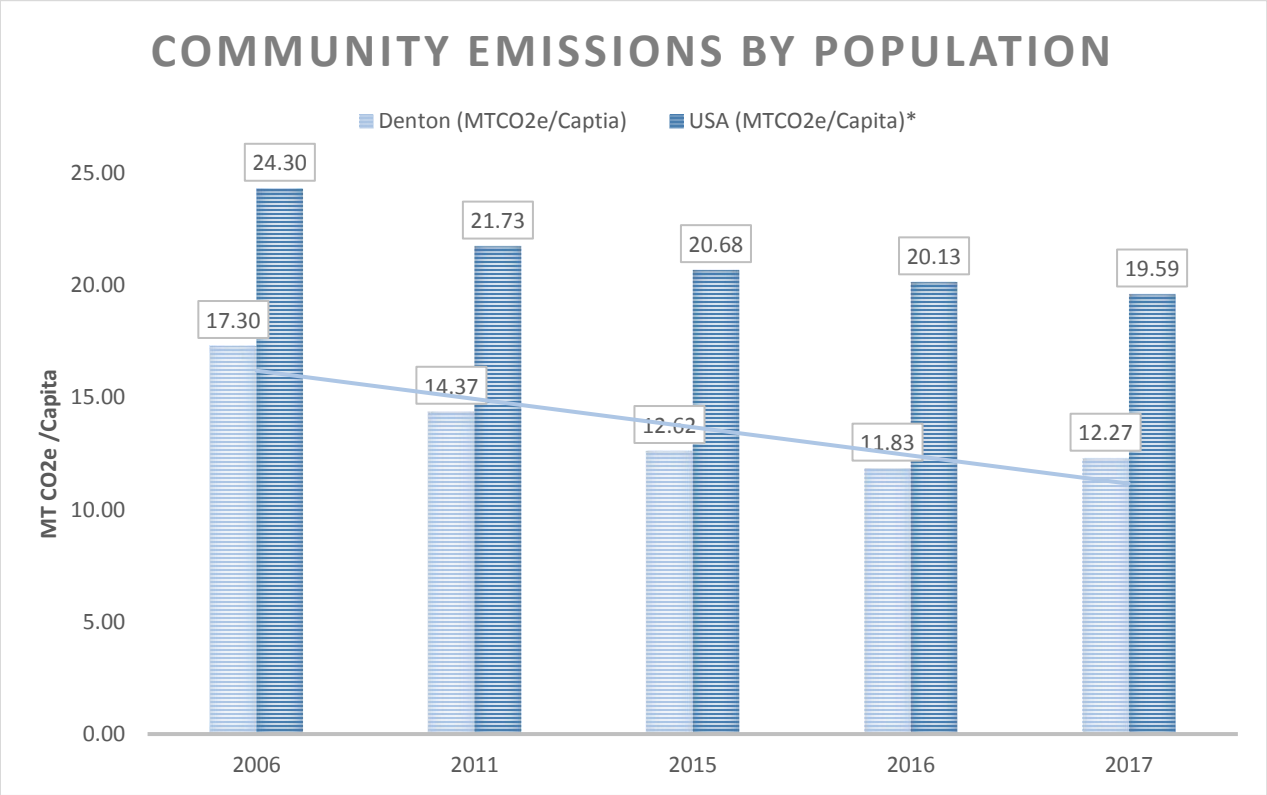

Figure 8

As we take a closer look at the numbers for this reporting year, **Figure 9** shows us how emissions from community activities are distributed by source type. These include transportation emissions, electricity and natural gas emissions from direct consumption, and methane emissions from decomposition. Understanding where GHG emissions in the community are coming from helps the City determine areas to focus future policy and improvement projects for long term GHG reduction goals.

Observing trends in each of these source categories is an important component of our ongoing reporting and tracking efforts. The City continues to implement new educational and outreach programs that are helping to reduce the community's carbon footprint, it is valuable to see how those efforts translate into tangible GHG reductions. To get a better sense of how each emission source is trending since our baseline year of 2006, **Figure 10** breaks down these changes year over year, while **Figure 11** shows the percentage changes over the base year. For an annual comparison, **Figure 12** shows the percentage changes over the previous Inventory year.

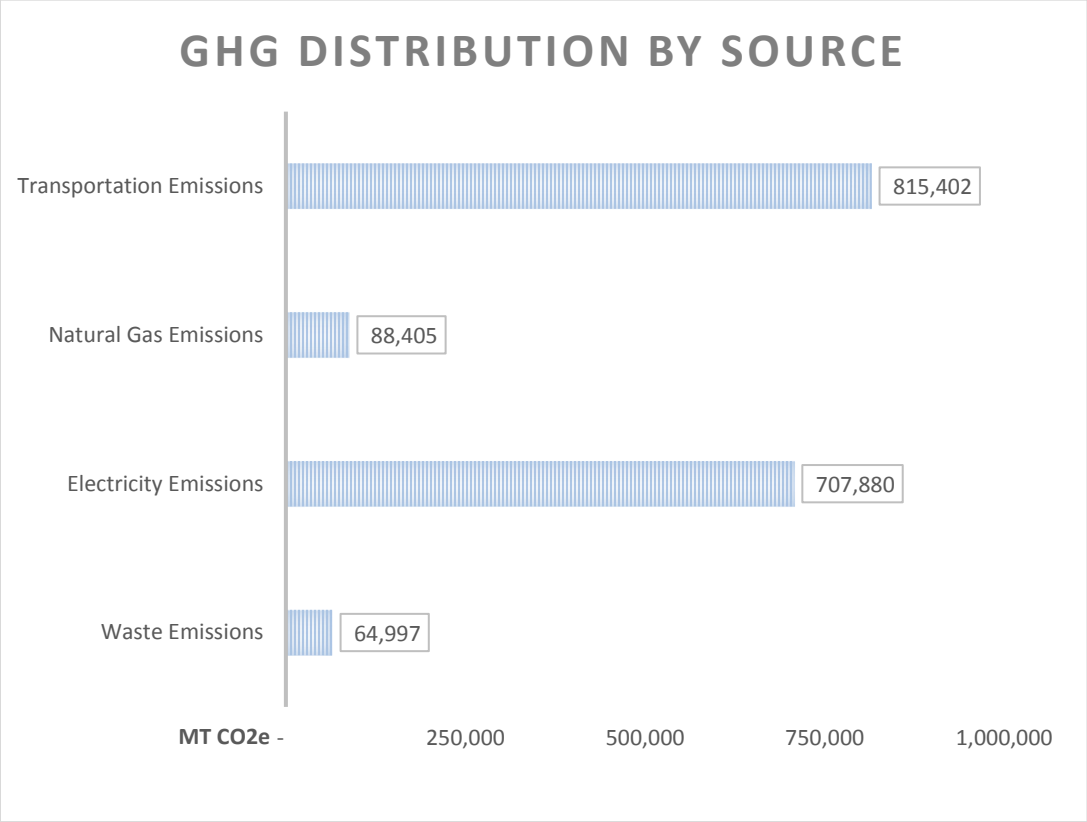

Figure 9

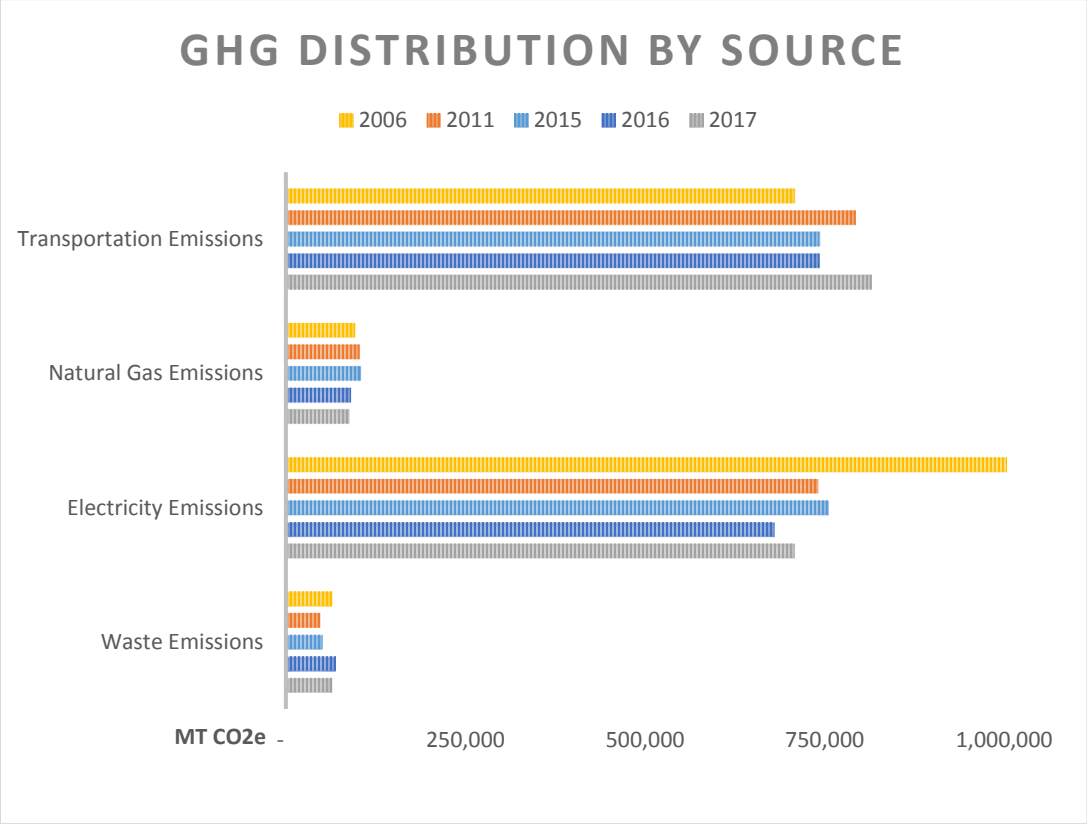

Figure 10

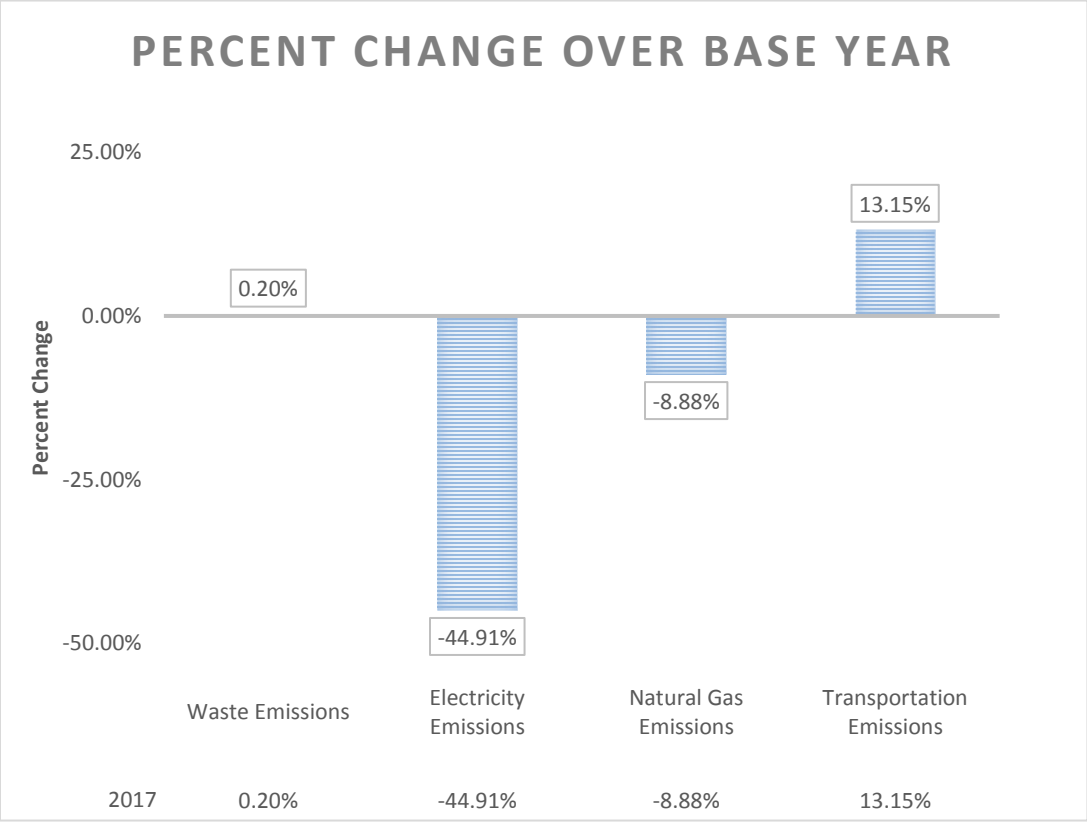

Figure 11

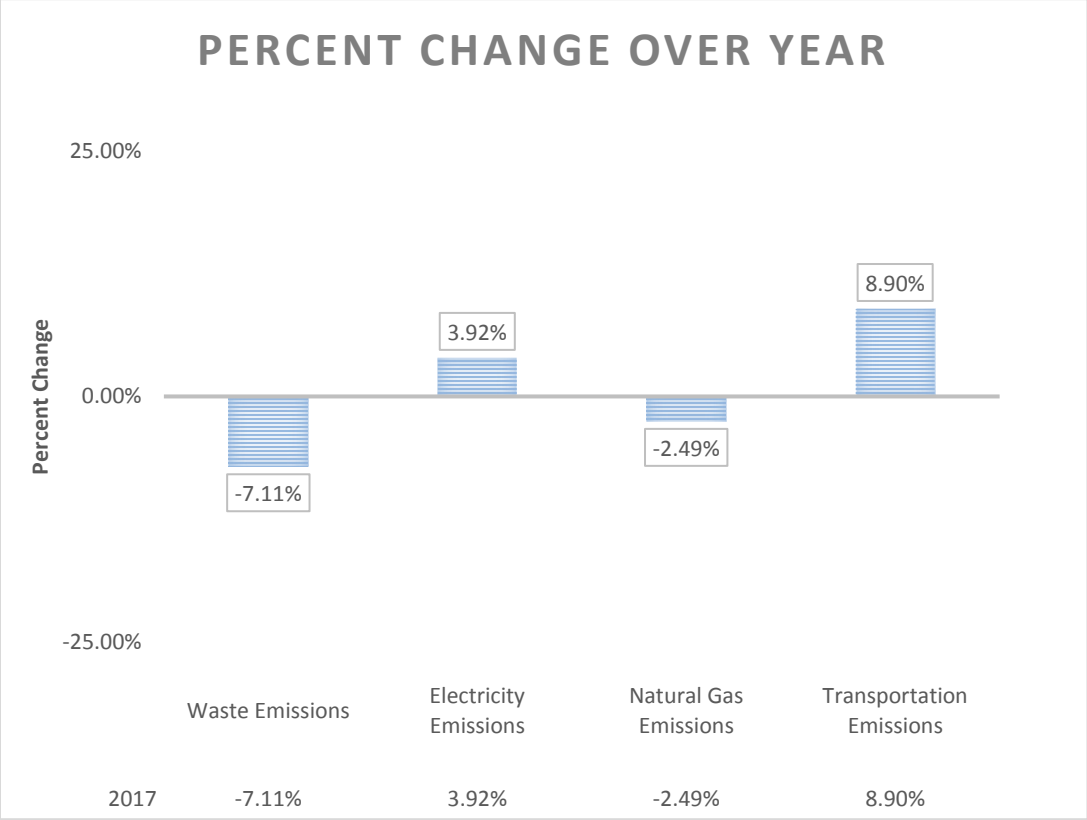

Figure 12

Community-Scale Summary:

The following highlights represent any major changes or trends in Denton's community scale GHG inventory for the year:

- Overall, the Denton community has successfully decreased our total GHG emissions by nearly 13% since 2006, the base year of reporting. During that same time, we have also decreased total GHG emissions per capita by 41%;
- Per capita electricity consumption continues to in the right direction, reducing slightly compared to 2016. Though total electricity consumption did increase by 1% over last year, industrial users represented nearly 75% of those increases. Between this slight increase in total consumption, as well as the emission factor increases described in the Municipal-Scale Summary, Denton increased total electricity emissions by nearly 4% compared to 2016. Emissions are still down significantly compared to the base year - now standing at a 45% reduction since 2006.
- After observing an increase in waste emissions last year, there was a 7% decrease in 2017. Considering that overall tonnage of disposed waste increased by 7% during this period of time, the most likely reason for the total emissions decreasing is that the contractor who operates the gas-to-energy generator ran the system more efficiently and

with less downtime. Operational efficiencies across the board play a huge factor with emission rates at the landfill;

- Natural gas emissions decreased community-wide by 2.5% compared to 2016. This was led by the residential sector, which decreased consumption rates by over 8%. Energy conservation education and incentive programs continue to support improvements in this sector; and
- Updated modeling observed that daily vehicle miles traveled (VMT) increased by nearly 9% compared to 2016. The major areas of increase were freeways, freeway ramps, and frontage roads. This is likely the result of a continued increase in regional population and a growing economy (see GHG Inventory Summary comments for further explanation). Considering transportation emissions comprise nearly 50% of all Community-Scale emissions, this sector increase was a major cause for the overall inventory to increase compared to 2016.

Moving Forward:

The following strategies will maximize our work to reduce Community GHG emissions:

- Continued community education about ways to conserve energy, reduce waste and increase recycling, drive less, and choose efficient transportation options;
- Continued increase of renewable energy resources in DME's fuel mix;
- Continued support of energy audit and rebate program;
- Continued adoption of most recent energy efficiency codes;
- Continued development of alternative transportation options;
- Continued support of alternative fuel vehicle deployment; and
- Continued participation with State and regional partners on energy efficiency measures.

2017 GHG Inventory Summary

2017 marks the first GHG Inventory that the City of Denton has observed an annual increase in our Community-Scale emissions. Components of the electricity emission factors and transportation vehicle miles traveled were the major factors for these changes. On a positive note, methane emissions generated from solid waste disposal countered growth trends dating back to 2011. Current levels of waste emissions are now back to base year levels. To offer expanded clarification, please consider the following summaries of key sectors;

- **Electricity Emission Factors**
    - Natural gas prices in the electricity supply market were slightly higher during 2017 compared to 2016, making coal slightly cheaper. This energy supply switch resulted in higher emission factors for electricity consumed in Denton. In other words, for every MWh of electricity consumed in Denton the MTCO2e increased by nearly 3% compared to 2016.

- Industry led tests have observed newly installed, high-efficiency natural gas-fired power stations can produce up to 70% lower GHG emissions than existing coal-fired generators. In light of this, a small switch from one source to the other can have a dramatic impact on emission factors.

- **Community VMT**
  - Data modeling within the NCTCOG Metropolitan Transportation Plan is the source for community vehicle miles traveled (VMT). Updates to these Mobility Plans are provided every five years, unless amendments are adopted. The 2015 and 2016 GHG Inventory used the Mobility 2035, originally published in 2011, which is why they show similar levels of MTCO2e. Since conducting the 2016 GHG Inventory, Mobility 2040 was adopted and is thus being utilized for this 2017 GHG Inventory.
  - Due to the non-cyclical nature of this data, it is fair to assume that some level of the increased emission rates observed in 2017 can be respectively distributed over previous years. In other words, the nearly 9% increase observed between the 2016 and 2017 inventory is actually representative of changes in VMT between 2012 and 2016. If this metric is applied proportionately over these years, then the annual change would be approximately 2%. This is of particular interest to our analysis because that growth rate happens to be correlate with regional population growth rates.
- **Municipal Fleet Fuel Consumption**
  - Since 2011, fuel consumption by the municipal fleet has been increasing incrementally. There are two clear explanations for this trend:
    - Utility services continues to rise with population growth and development; and
    - Fuel economy of heavy-duty vehicles is not being federally regulated like it is with passenger cars and light duty trucks.
  - Departmental trends being observed, suggest that our largest increases are in Wastewater Collection, Wastewater Drainage, Electric Ops, Electric Distribution, Wastewater Beneficial Reuse, Water Distribution, and Solid Waste. The fuel consumption amounts of these departments are disproportionally greater than others because they mostly operate heavy equipment. These vehicles get low mileage rates to begin with, buy when you consider the market is not seeing pressure from regulators to improve fuel economy it's difficult for the City to achieve reductions in consumption while the demand for services rises.
  - Comparatively speaking, departments that have achieved significant reductions in fuel consumption are Street, Police, Parks and Recreation, and Fleet. As the City continues to replace older vehicles with newer, more fuel efficient options via our Green Fleet Policy, these departments are seeing the benefits of improvements in fuel economy.

As a full-service municipality, many operational efficiencies and emission reductions achieved through projects such as municipal energy efficiency retrofits, purchase of wind energy, and the landfill methane-to-energy project, translate into community-wide savings.

The City continues to track municipally generated emissions and has identified key areas to further reduce locally generated emissions, promoting several overlapping city goals for health, livability, environment, and economic development. These goals and plans will be further outlined in the City's Air Quality and GHG Action Plan, under development.

Residents seeking to reduce their carbon footprint can visit the City's Sustainability website, www.sustainabledenton.com, for a variety of resources. Energy audits and rebates provided by the City to its customers are an ideal tool to improve energy efficiency in homes and business. Public and alternative transportation information can also be found through this site.

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