

Greenhouse Gas Inventory: 2015

DRAFT Summary Report

Environmental Services and Sustainability

December 2016



Welcome to the City of Denton's 2015 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 2015. 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.

The inventory report for 2002, 2006, and 2011 can be found at [\[insert link\]](#). The City of Denton completes Denton GHG inventories approximately every five years.

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.

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 human health, environmental, economic, and social impacts. Expected 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.¹

“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).”

“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 “authoritative source”² 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;”³ and
2. “The IPCC is now 95 % certain that humans are the main cause of current global warming.”⁴

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

- United States Environmental Protection Agency (USEPA) Climate Change: <http://www.epa.gov/climatechange/>
- 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/>

¹ USEPA-1

² USEPA-4

³ IPCC AR5, *SPM* p 4

⁴ IPCC AR5, *SR* p v

Software for Tracking Greenhouse Gas Emissions (GHGs): 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, 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 as a whole. The software uses the latest methods and emissions factors to translate this data into equivalent CO₂ emissions. Equivalent CO₂, abbreviated as CO₂e, is the amount of CO₂ that would have the same, or equivalent, global warming potential as the actual mix GHG emissions produced (including CO₂, CH₄, N₂O, 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 2015 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 inventory protocols, as well as some updates and refinement of internal tracking, including:

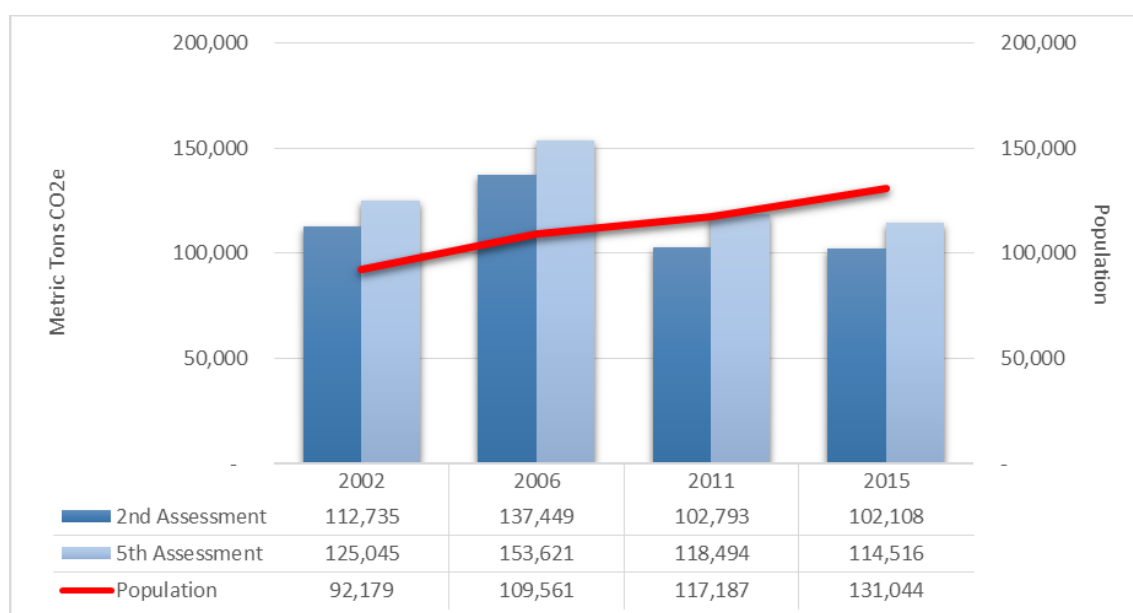
- The 2015 Inventory is based on the IPCC's 5th Assessment report as updated in ClearPath. One important update for the 5th Assessment includes a larger global warming potential assigned to methane (CH₄). In order to compare "apples to apples," the inventories for previous years (2002, 2006, and 2011) were updated to reflect the 5th Assessment values. **Figure 1** includes original values for the 2002, 2006, and 2011 Inventories (using 2nd Assessment values) as well as 5th Assessment values, for comparison to 2015.
- City of Denton municipal electric accounts have been fully reviewed and updated for 2015. All electricity consumption pertaining to facilities and operations for Solid Waste, Water Production, Wastewater Treatment, or Streetlights and Traffic Signals, are reported under these categories; all other municipal electric consumption is reported under Buildings and Facilities. Buildings associated with Solid Waste had previously been reported with Buildings and Facilities.
- Additional data on vehicle classes and emissions factors was available for City of Denton fleet, compared to previous inventory years, allowing for further accuracy in estimation.

- Substantially more complete data was provided for both CoServe and Oncor customers within the City of Denton boundaries for 2015, resulting in more electricity consumption being reported for these two utilities in the community inventory.
- Transmission and Distribution losses are now recommended to be reported as Scope 3 for community protocols, but Scope 2 for Municipal inventories. T&D losses are included in figures 2, 4, and 8, but excluded from emissions totals.

City of Denton: GHGs from Municipal Operations

Figure 1 summarizes the total annual GHG emissions in metric tons of Carbon Dioxide equivalents (CO₂e) from City of Denton municipal operations for each of our recorded inventory years. For each year, we report values using two separate Assessment methodologies: the 2nd Assessment, which was previously used, and the 5th Assessment, which is the current protocol. **Figure 2** shows how each sector of municipal operations breaks down as a percentage of the total, including DME T&D Losses.

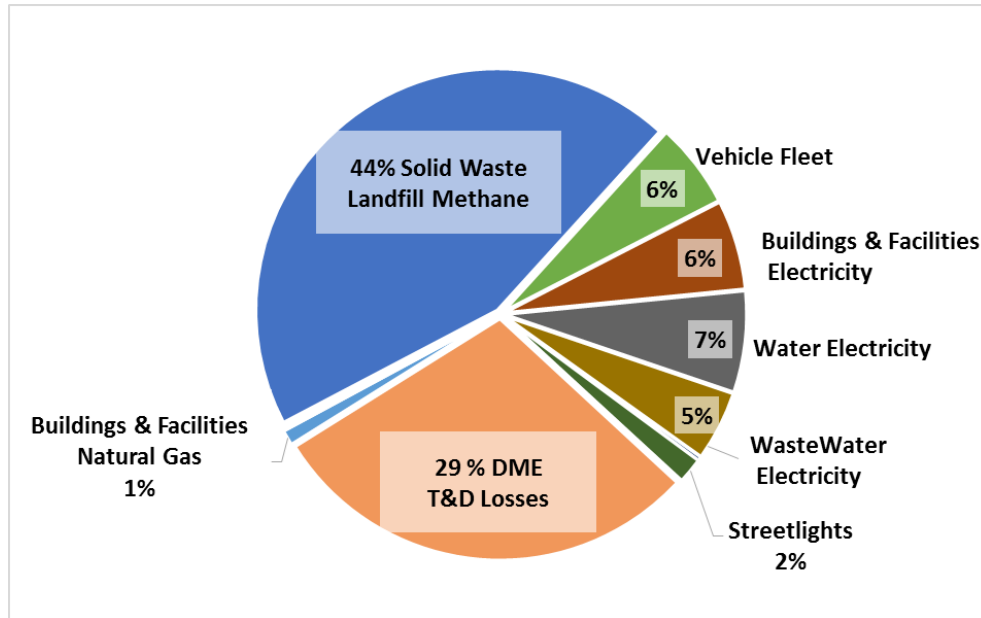
Figure 1: Annual Greenhouse Gas Emissions in MT CO₂e for Municipal Operations (Scopes 1 & 2)



As can be seen in **Figures 2-4**, all GHGs from municipal operations come from either energy-related activities, including the transportation sector, or from decomposition of solid (landfill) or liquid (wastewater treatment facility) waste. It is important to note that the Local Government Protocol requires reporting emissions from all government provided services, including emissions from a City operated landfill, and from electric transmission and distribution (T&D) losses (the energy lost due to friction in electric transmission lines bringing power to a City and through the electric distribution lines) for a municipal electric utility like DME. When included in the

municipal inventory, one can see that T&D losses represent one of the largest sources of GHG emission from municipal sources for Denton. However, DME's T&D losses are below the national average and opportunities to reduce T&D losses are very limited. Therefore, we also consider municipal GHG emissions, excluding T&D losses, so that we can focus on areas where our efforts can have more impact.

**Figure 2: 2015 GHG Emissions from Municipal Operations by Source.
5th Assessment**



**Figure 3: 2015 GHG Emissions from Municipal Operations by Source.
Excluding DME T&D Losses. 5th Assessment**

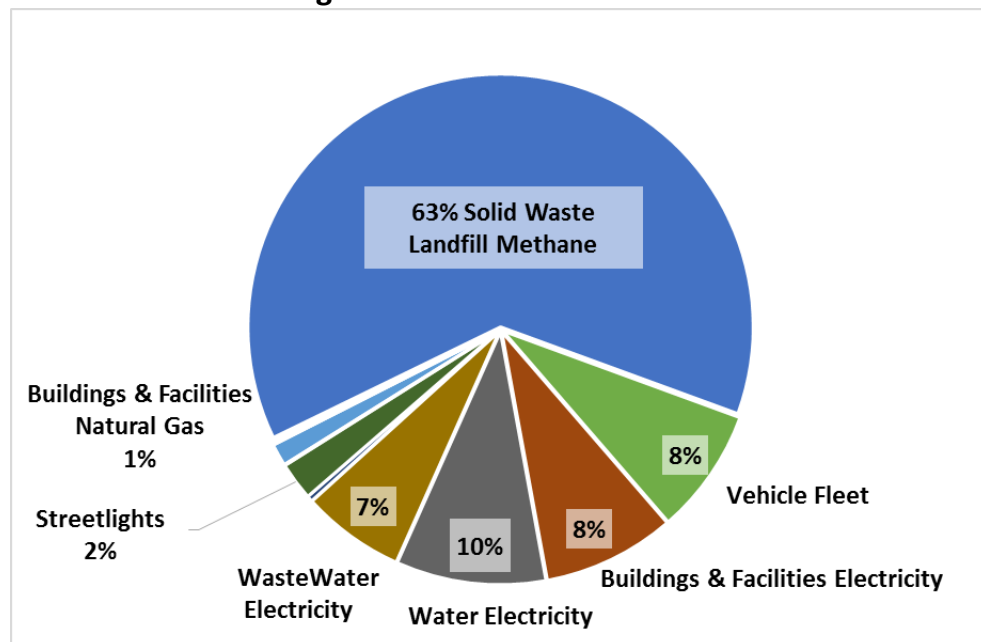


Figure 4 presents more detailed emissions breakdowns by source for all inventory years, using the 5th Assessment assumptions.

Figure 4. GHG Emissions (in MT CO₂e) by Source for Municipal Operations- All Inventory Years. 5th Assessment Values.

Scope	Source	2002	2006	2011	2015
Scope 1	Buildings and Facilities - Natural Gas	725	725	1,100	1,149
	Water - Natural Gas	9	9	17	7
	Wastewater- Natural Gas	89	89	199	85
	Wastewater- Digester Methane	71	136	137	122
	Solid Waste - Landfill Methane	49,342	64,732	47,684	50,881
	Vehicle Fleet	5,874	10,121	6,318	6,532
	Transit Fleet	400	2,394	-	-
Scope 2	Buildings and Facilities - Electricity	10,935	12,018	7,260	6,866
	Water- Electricity	8,845	10,761	7,931	7,762
	Wastewater- Electricity	5,506	6,182	8,921	5,343
	Solid Waste - Electricity	*	*	*	291
	Street Lights	2927	3,291	2,212	1,960
	Traffic Signals	640	152	46	44
	Electric Power Production : T&D Losses	39,682	43,011	36,670	33,474
Total (Scopes 1 & 2)		125,045	153,621	118,494	114,516
Scope 3	Solid Waste	9,163	2,291	2,470	2,388
	Employee Commute	3,133	3,528	3,705	3,515
Total (Scopes 1,2, &3)		137,342	159,439	124,669	120,419

Key Points:

Overall municipal GHGs (scopes 1 & 2) have **fallen 8% since 2002**, with a **25% reduction since 2006**. Generally we continue on a downward emissions trend, with a **3% reduction from 2011 to 2015**. Despite being a full service municipality, **municipal emissions per capita** have also steadily dropped over time from 1.36 to .88 metric tons CO₂e/person, a **36% reduction**, from 2002 to 2015.

The largest sources of municipal GHGs are **landfill methane (44%)** and emissions from **electricity consumption (49%)**, including T&D losses, in buildings and facilities, and water and wastewater operations. Streetlights (2% of total municipal GHGs) and traffic signals (<1% of total municipal GHGs) represent a small portion of electricity related emissions. The following GHG sources also represent less than 1 % of total municipal GHG's both when including and excluding DME T&D Losses: Water Natural Gas, Wastewater Digester Methane, Wastewater Natural Gas, Solid Waste Electricity.

Electricity related emissions have dropped by 26% from 2006, largely due to DME purchasing 40% wind electricity for all Denton customers beginning in 2009. It is important to note, that electricity related emissions from municipal operations dropped 11% from 2011 to 2015. ***DME reduced electricity purchases from coal by 44% from 2011 to 2015.***

The City's commitment to improving fleet efficiency, including the number of alternative fueled vehicles, has led to a ***decrease in fleet emissions of 35% from 2006 to 2015.***

Landfill sourced emissions dropped between 2006 and 2011, due to the addition of ***comprehensive landfill methane collection*** in 2006, and a ***landfill gas to energy power plant*** in 2008. However, ***emissions grew by 7% from 2011 to 2015.*** This increase reflects the 57% increase in waste collected during this period. In addition to the comprehensive gas collection and landfill to energy system, the City conducts regular landfill cover inspections, and utilizes compost on the landfill surface to serve as a biofilter and minimize fugitive emissions. In fact, the City's landfill draws hundreds of visitors each year from across the country and the world, who come to study best practices in landfill management, including emissions management.

Moving Forward:

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

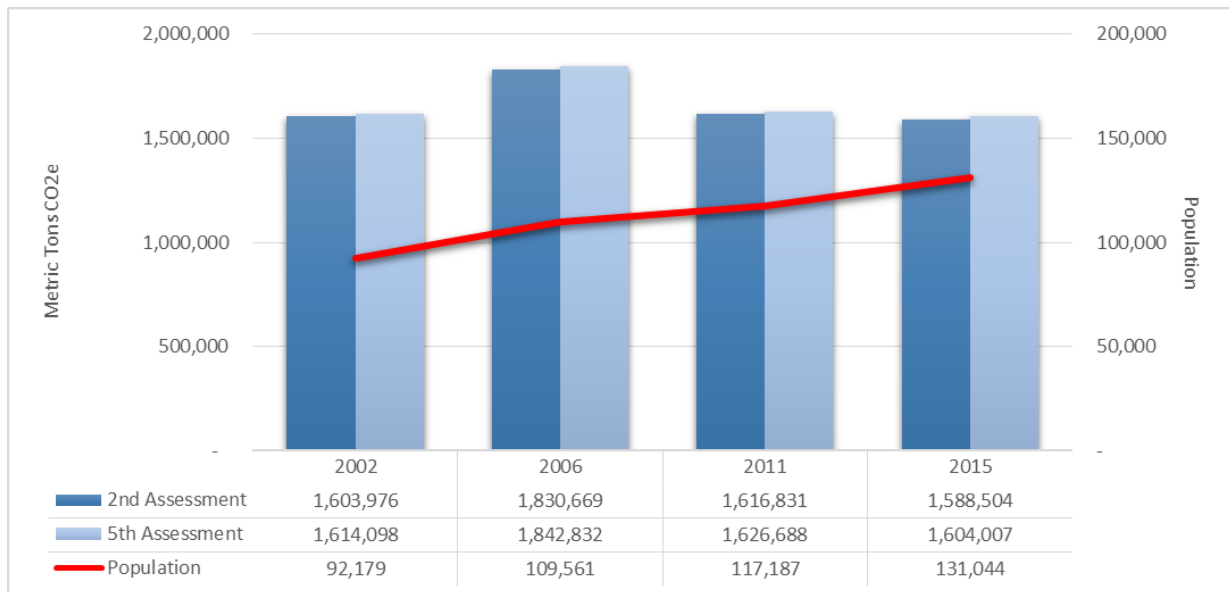
- Continued increase of renewable energy resources in DME's fuel mix;
- Prioritizing energy tracking and targeted efficiency projects, including retrofits and new construction, at municipal buildings and water and wastewater operations;
- Continued efforts to promote community recycling and reduce organics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

[photo?]

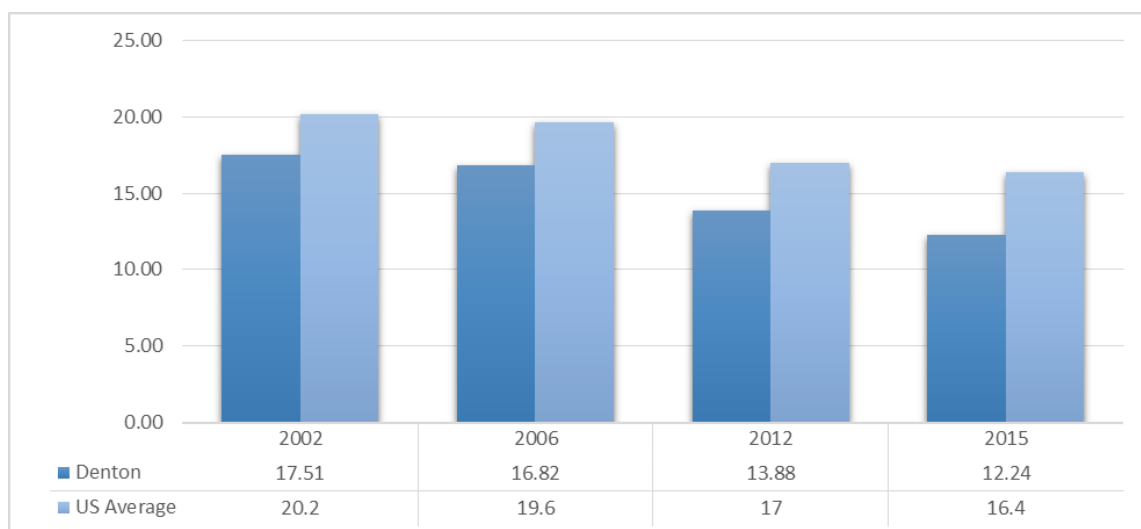
City of Denton: GHGs for Community Activities

Figures 5-7 summarize the total annual GHG emissions in metric tons of Carbon Dioxide equivalents (CO₂e) for the entire Denton community, including municipal operations, for 2015. Population figures, identified in red, are included for inventory years. Current protocols recommend T&D losses be considered as Scope 3 (optional) for reporting in Community inventories. Emissions due to T&D losses are reported in Figure 8, but excluded from totals in Figures 5-7.

Figure 5. Annual Community GHG Emissions in MT CO₂e (Scopes 1 & 2).



**Figure 6. Community GHGs (in MT CO₂e) Per Capita (Scopes 1 & 2).
5th Assessment Values.**



**Figure 7. 2015 Community GHG Emissions by Source.
5th Assessment Values.**

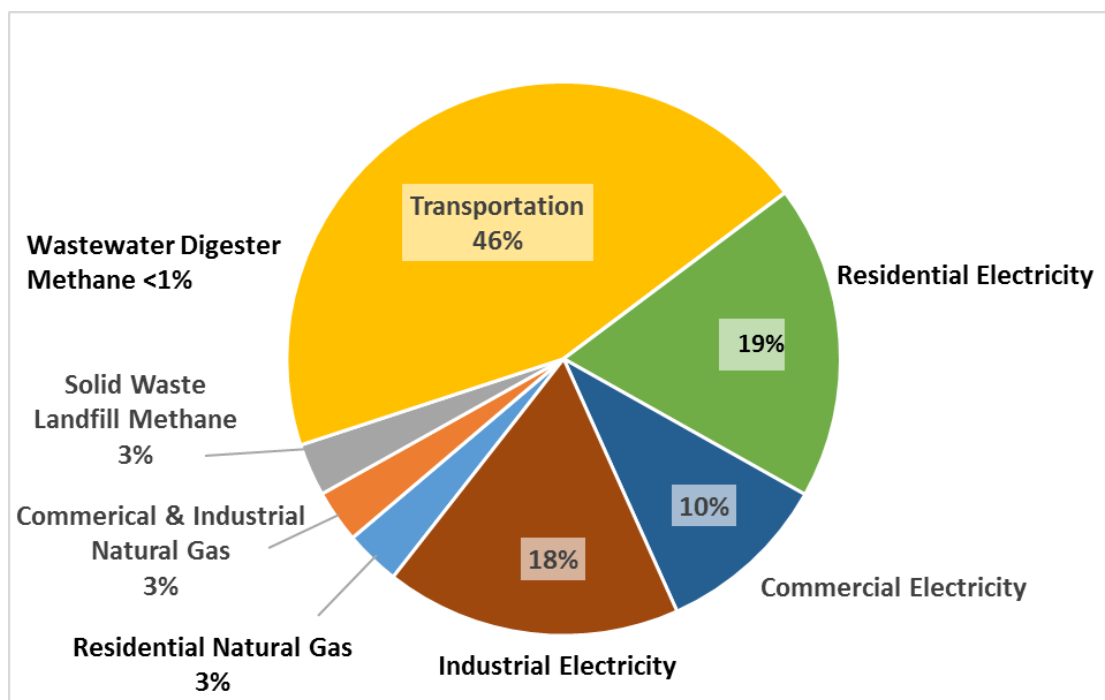


Figure 8 presents more detailed emissions breakdowns by source for all inventory years, using the 5th Assessment assumptions.

**Figure 8. Community GHG Emissions (in MT CO₂e) by Source for all Inventory Years.
5th Assessment Values.**

Scope	Category	2002	2006	2011	2015
Scope 1	Residential Energy - Natural Gas	56,710	52,214	56,737	53,944
	Commercial & Industrial Energy - Natural Gas	44,164	44,045	45,977	51,034
	Solid Waste - Landfill Methane	49,342	64,732	47,684	50,881
	Transportation	624,773	708,137	793,266	742,701
	Wastewater- Digester Methane	71	136	130	122
Scope 2	Residential Energy - Electricity	339,685	393,232	306,139	304,896
	Commercial Energy - Electricity	202,789	226,622	156,417	167,974
	Industrial Energy - Electricity	353,274	405,928	277,074	286,400
	Total Scopes 1&2	1,614,098	1,842,832	1,626,688	1,604,007
Scope 3	Electric Power Production : <i>T&D Losses</i>	39,682	43,011	36,670	33,474
	Total Scopes 1,2, & 3	1,653,780	1,885,844	1,663,358	1,637,481

Key Points:

Overall Community GHGs have *fallen 1% since 2002*, with a **13% reduction since 2006**. Generally we continue on a downward emissions trend, with a **1% reduction from 2011 to 2015**.

Community emissions per capita have also steadily dropped over time from 17.51 to 12.24 metric tons CO₂e/person, a **30 % reduction**, from 2002 to 2015. In addition, per capita emissions are 34% lower for Denton than for the U.S. average, in 2015 (World Bank).

The largest sources of community GHGs are from **transportation (46%)** and from residential (19%), commercial (10%), and industrial (18%) **electricity consumption (together totaling 47% of Community GHGs)**. Emissions from the wastewater digester represent less than 1 % of total municipal GHG's.

As with municipal operations, **Community electricity related emissions have dropped by 26% from 2006**, including a **3% drop from 2011 to 2015**. This reduction is largely due to DME purchasing **40% wind** electricity for all Denton customers beginning in 2009, and **reducing purchases from coal produced electricity by 44% from 2011 to 2015**. It is important to note, that electricity related emissions from municipal operations dropped 11% from 2011 to 2015. In addition DME expanded it's free residential and small commercial **energy audit program** in 2008, and launched the GreenSense **Energy Efficiency Rebate program** for residential and small commercial customers in 2009. The City created a Conservation Program Coordinator position in 2014 to implement the audit and rebate program, and to develop increased public education about energy and water conservation. In addition, the City created a Bike and Pedestrian Coordinator position in 2015, to implement the Bike Plan adopted in February 2012. The Coordinators responsibilities include promoting bicycle and pedestrian infrastructure, education, and community events.

Moving Forward:

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

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

Summary

The City continues to reduce both municipal and community generated GHG emissions. As a full-service municipality, many operational efficiencies and emissions 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: [\[update link\]](#). Public and alternative transportation information can also be found at [\[update link\]](#).

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