

CITY OF DALLAS GREENHOUSE GAS EMISSIONS INVENTORY: 2012



PHOTO BY SEAN FITZGERALD
2011 TRINITY RIVER PHOTO CONTEST 2ND PLACE PROFESSIONAL WINNER:
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Introduction and Methodology

Greenhouse gases are gases that trap heat in the atmosphere. The primary greenhouse gases and their sources are:

- Carbon Dioxide (CO₂): Principal greenhouse gas; emitted through the burning of fossil fuels (oil, natural gas, coal), solid waste, trees and wood products, and other chemical reactions
- Methane (CH₄): Emitted during the production and transport of coal, natural gas, and oil; Also result from livestock and other agricultural processes and from the decay of organic waste in solid waste landfills
- Nitrous Oxide (N₂O): Emitted during agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste
- Fluorinated Gases: Emitted from a variety of industrial processesⁱ

Levels of global emissions of greenhouse gases are rising fast. According to a report by the Global Carbon Project, an international collaboration of scientists, global emissions increased 5.9 percent in 2010 when compared to 2009. This increase, representing a half billion extra tons of carbon, was the largest jump in any year since the Industrial Revolution. The report showed that the combustion of coal made up more than half of the growth in emissions.ⁱⁱ

The United States is the second largest contributor to greenhouse gas emissions, emitting 1.5 billion tons of carbon compared to China's levels of 2.2 billion tons of carbon.ⁱⁱⁱ

Increasing levels of greenhouse gas emissions are of particular concern since greenhouse gas emissions contribute to an increase in the average temperature of the earth. Rising temperatures in turn may cause changes in weather, sea levels, and land use patterns.^{iv} Given the trend toward increasing global emissions and the effects such emissions can have, it is important to monitor greenhouse gas emissions and reduce these emissions for the health and safety of future generations.

As a major land owner, water utility owner, building owner, employer, fleet operator, and service provider, the City of Dallas recognizes its carbon footprint. In 2006, the Mayor of Dallas signed the U.S. Conference of Mayors Climate Protection Agreement which is a commitment by U.S. mayors to reduce greenhouse gas emissions to 7% below 1990 levels by the year 2012. In order to measure the City's progress with meeting this agreement, the City conducted its first greenhouse gas inventory using a baseline year of 2005. Results from this first inventory showed that the City was on track to meet this. The 2005 baseline greenhouse gas inventory also reported on greenhouse gas emissions from community sources.

In 2011, the City conducted a second inventory of municipal and community-wide sources using the baseline year of 2010. The results of this report are shown on the following web pages, where we present the 2010 GHG emissions inventory and compare it with the 2005 inventory. In addition, we also present the projected emissions

for years 2012, 2015 and 2020 for the City of Dallas based on planned expansions, and for the Dallas community based on population growth and demand for energy sources such as electricity, fuel oil, and natural gas. Throughout this report, the Greenhouse Gases (GHG) emissions are reported in metric tons.

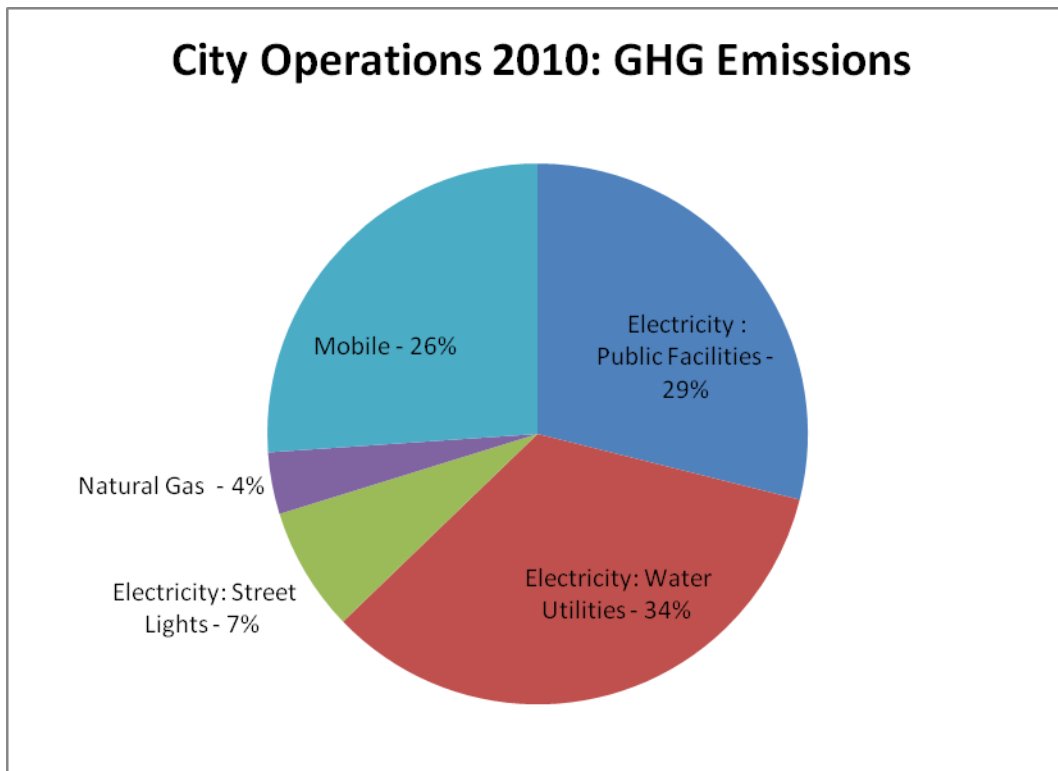
The table below shows the different models and data sources used in the report to estimate GHG emissions.

Source Type	Model Used (for 2010 Estimates)
Electricity Consumption	Emission factors from U.S. Energy Information Administration and EPA Website
Fuel Oil Consumption	U.S. Energy Information Administration's website
Natural Gas Consumption	U.S. Energy Information Administration's website
On-Road Mobile Sources	MOVES 2010a (U.S. EPA)
Non-Road Mobile Sources	NONROAD2008a (U.S. EPA)
Solid Waste (Landfill Site)	LandGEM v3.02 (U.S. EPA)

The sections of this report include:

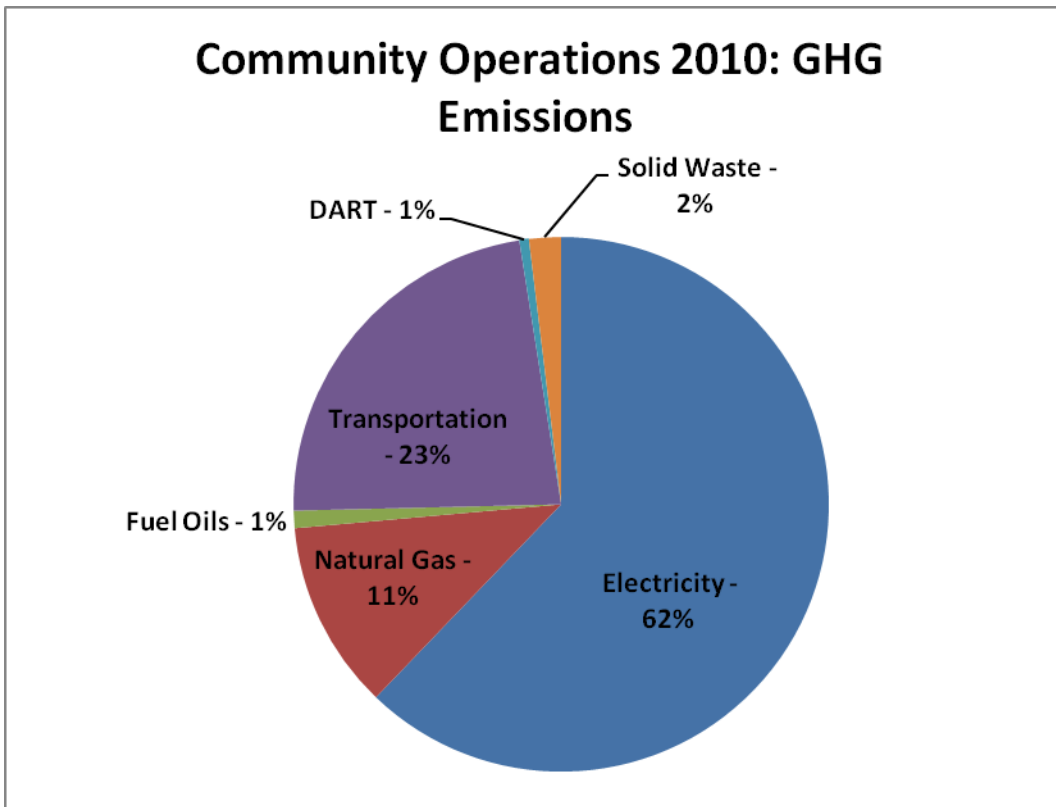
- 2010: GHG Emissions by Emissions Source for City Operations (pg 3)
- 2010: Community-Wide Greenhouse Gas Emissions (pg 4)
- Comparison of Greenhouse Gas Emissions from City Operations: 2005 and 2010 (pg 5)
- Comparison of Greenhouse Gas Emissions from Community Operations: 2005 and 2010 (pg 7)
- Results and Forecasting Future Emissions (pg 10)

2010: GHG Emissions by Emissions Source for City Operations



City Operations:2010 GHG Emissions	
Source	Metric Tons/Year
Electricity - Public Facilities	116,370
Electricity - Water Utilities	136,418
Electricity - Street Lights	29,891
Natural Gas	14,888
Mobile Sources	104,993
City Operations Total	402,560

Community-Wide Greenhouse Gas Emissions



Community-Wide Emissions: 2010 GHG Emissions	
Source	Metric Tons/Year
Electricity	10,714,678
Natural Gas	1,961,833
Fuel Oils	181,092
Transportation	3,939,248
DART - Public Transit	99,579
Solid Waste	332,957
Community-Wide Total	17,229,388

Comparison of Greenhouse Gas Emissions from City Operations: 2005 and 2010

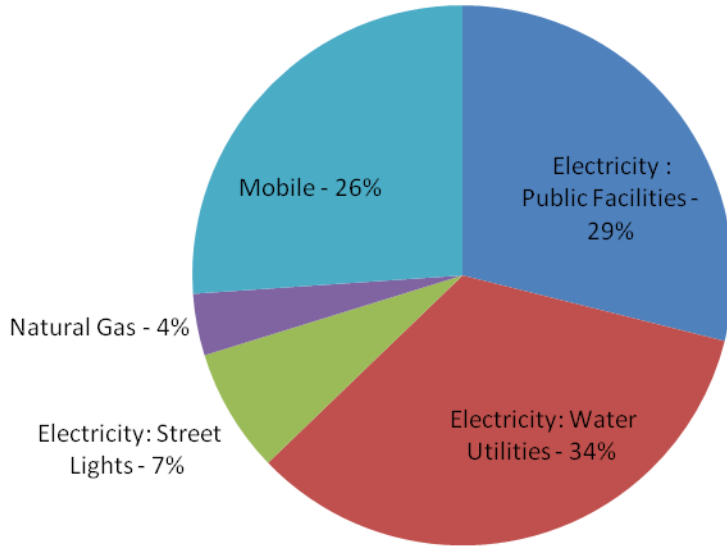
In this section we compare the results from the 2005GHG inventory results with the results obtained for the year 2010. The pie-charts compare the GHG emissions by emission source for the year 2005 and 2010, from City operations. In the 2010 inventory, we have included stationary and non-road equipment that are sources of GHG emissions in the Love Field airport. Non-road equipment was not reported by the Executive airport.

In the table below, we see that the emissions from electricity consumption are lower in the year 2010 because the City of Dallas used 40% of energy generated by renewable energy sources. Purchasing such a large percentage of renewable energy has particularly helped the City reduce the overall GHG emissions as well.

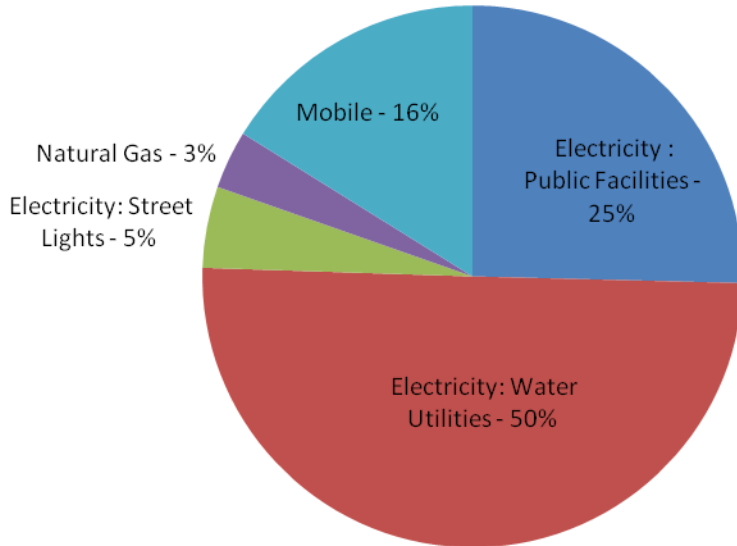
Despite these differences in the modeling approach, estimated GHG emissions are within our expectations considering factors such as improvements in technology (resulting in lower emissions from the City's mobile sources inventory) despite an increase in equipment population (16% increase in non-road and on-road equipment population). Improved methods implemented in emission estimation tools (such as updated NON-ROAD 2008a model, and the new MOVES 2010a) may also contribute some variability in the 2010 emission estimates in comparison to the 2005 estimates. For example, MOVES2010a implements a more robust approach in order to estimate on-road vehicle emission that includes emission variability due to differences in link speed and road type. In addition, MOVES2010a includes emission during startup and idling. Emissions due to such operations and factors are not included in the Mobile 6 model used in the 2005 estimates.

City Operations: GHG Emissions			
Source	2005 (Metric Tons/Year)	2010 (Metric Tons/Year)	Percent Change
Electricity - Public Facilities	166,751	116,370	-30%
Electricity - Water Utilities	329,233	136,418	-59%
Electricity - Street Lights	31,933	29,891	-6%
Natural Gas	22,881	14,888	-35%
Mobile Sources	106,017	104,993	-1%
City Operations Total	656,815	402,560	-39%

City Operations 2010: GHG Emissions



City Operations 2005: GHG Emissions



Comparison of City of Dallas GHG Emissions by Emission Source: Years 2005 and 2010.

Comparison of Greenhouse Gas Emissions from Community Operations: 2005 and 2010

In this section we compare the results from the 2005 inventory results with the results obtained for the year 2010. The pie-charts compare the community level GHG emissions by emission source for the years 2005 and 2010.

In the table below, we see that the 2010 GHG emissions from community level electricity consumption are lower than the emissions from electricity consumption in the year 2005. This may be because of the decrease in the City's population (a 6% decrease in population from 2005 to 2010). In addition, emissions from electricity generation used in this work (2010 estimates) are based on updated emission factors as published in the US EPA website and are made available here (<http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>). The 2005 estimates used an emission factor of 1.42 lb/kWh, the updated emission factor used in this work (developed by the US EPA) was 1.25 lb/kWh. Increased use of renewable energy sources and energy efficient household appliances (such as energy star products) are also suspected to have helped reduce community emissions from conventional energy sources (such as electricity generation) in 2010 in comparison to the year 2005.

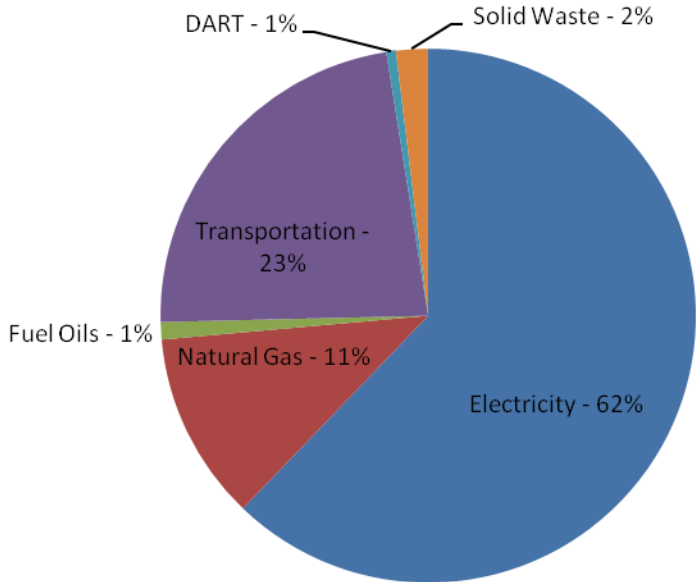
We also note that the 2010 Greenhouse gas emission estimates from the solid waste site were estimated using US EPA model: LandGEM v3.02, USEPA recommended model to estimate emissions from solid waste sites. The 2005 inventory work estimated emissions from the solid waste site to be 152,938 metric tons based on the assumption that 25% of the Landfill Gas (LFG) and about 55% of the methane was unrecovered from the solid waste site. The difference between the unrecovered LFG and methane was then used to estimate the unrecovered carbon dioxide (GHG emission). Using LandGEM v3.02 model, GHG emissions from the solid waste site during 2005 was estimated to be 305,857 metric tons.

Community Wide Emissions: GHG Emissions			
Source	2005 (metric tons/year)	2010 (metric tons/year)	Percent Change
Electricity	12,043,444	10,714,678	-11%
Natural Gas	1,733,583	1,961,833	13%
Fuel Oils	226,984	181,092	-20%
Transportation	4,042,345	3,939,248	-3%
DART - Public Transit	98,523 ^S	99,579	1%
Solid Waste	305,857*	332,957	9%
Community Wide Total	18,450,736	17,229,388	-7%

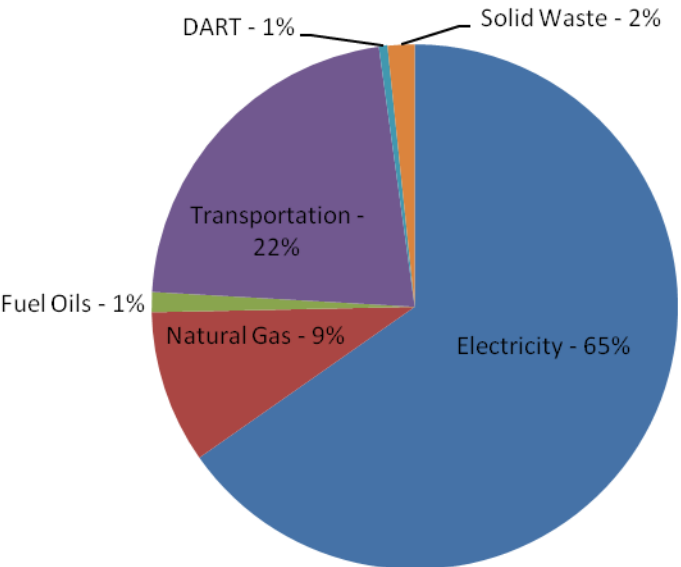
§ - Emission estimated using MOVES 2010a model. The 2005 inventory work reported the emissions from DART (public transit) to be 66,419 metric tons, an estimate derived based on the volume of fuel used.

* - Emission estimated using LANDGEM v3.02 model. The 2005 inventory work reported that the solid waste GHG emissions were 152,938metric tons; an estimate derived using empirical equations.

Community Operations 2010: GHG Emissions



Community Operations 2005: GHG Emissions



Comparison of Community Level GHG Emissions by Emission Source: Years 2005 and 2010.

Results and Forecasting Future Emissions

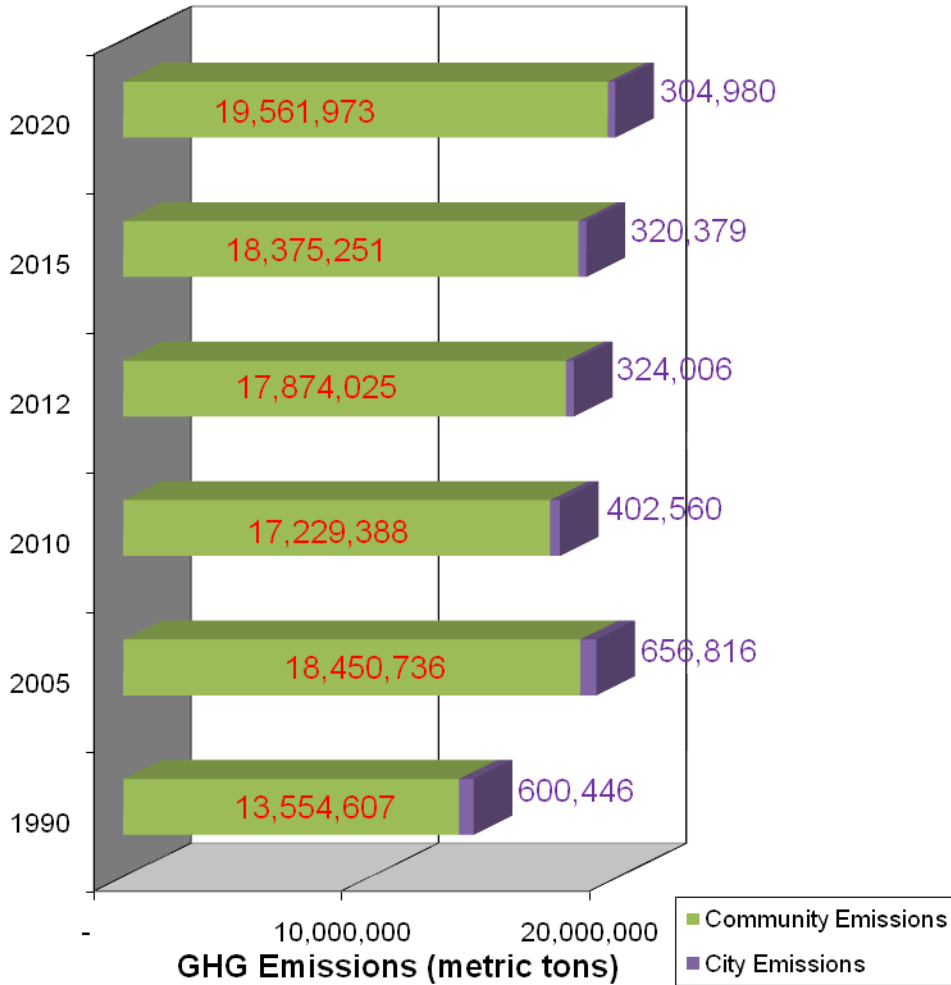
The figure shown below illustrates the projected City and Community level emissions. The emissions plotted for the years 1990, 2005 and 2010 are actual estimates, while the estimates for 2012, 2015 and 2020 are projected emissions.

The projected City emissions are based on expected growth rates. For example, facilities growth projections were provided by City departments. Community emission projections from natural gas and fuel oils, DART, and solid waste are calculated based on projected population, and based on the per capita level emission in the year 2010.

The estimated GHG emissions from City operations during 2010 were 402,560 metric tons. This amount is approximately 33% less than the emissions during the year 1990. Clearly, the City of Dallas has already attained the goal of emissions of 7% less than the emissions during the year 1990 by 2012. The main driving factors that may have helped attain this goal are (1) the purchase of renewable energy sources (at 40%) for the City's electricity consumption, and (2) the energy efficiency improvements in the power generation sector.

We also note that there are planned expansions for some of the City's facilities. Therefore, it is important to note that unless the City continues to invest in energy efficiency improvements (including the planned green building initiatives etc. that are included in the projections), along with additional investments to garner energy from renewable energy sources, it may be difficult to attain GHG emissions lower than the 2010 levels in the future years.

Dallas GHG Emissions Timeline



Projected City and Community Level Emissions with Actual Estimates for Years 1990, 2005 and 2010. *Note: Numbers in red font indicate community emissions and purple font indicate City emissions.*

ⁱ Environmental Protection Agency

ⁱⁱ New York Times, “Carbon Emissions Show Biggest Jump Ever Recorded”, December 4, 2011

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^{iv} Department of Energy