City of University City, Missouri

2010-2011 Baseline Greenhouse Emissions Inventory and Forecast

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City of University City, MO

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Sincerely,

Joseph E Heneberry

Joe Heneberry, Environmental Assistant, City of University City, MO

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Introduction

Executive Summary

In 2009, the University City, Missouri City Council adopted a resolution that recognized the performance of a Greenhouse Gas (GHG) Emissions Inventory as a necessary first step in reaffirming its commitment to integrate sustainability in its decisions, actions, activities, purchases and community outreach. The culmination of this report, completed with the assistance of ICLEI-Local Governments for Sustainability, marks the beginning of the City's efforts to identify and reduce greenhouse gas emissions.

In order to make the best decisions to reduce the community and the City's ecological footprint (carbon, methane, water, and natural resource use), some preliminary evaluative measures must be taken. It is a typical planning approach (evaluate, plan, implement, evaluate). Thus it is standard protocol to assess the existing carbon footprint of the city in order make specific sustainability decisions and then measure the impact of actions taken. There are two primary measurements that must be assessed: the greenhouse gas (GHG) inventory and energy audits of city facilities. The first will look at the City's greenhouse gas emissions, as well as the community's. A subset of the first is to have energy audits conducted at each of the City's facilities. Through knowledge of the sources of our emissions and energy usage, better and more informed decisions about capital improvements, behavior changes and policy can be made. Based on data about where we are currently, the ultimate goal of the Green Practices Committee is to devise a sustainability plan that leads our community to have zero impact on the earth.

While it may seem like the actions of one community cannot change the global climate, it is the Green Practices Committee's belief that if each community measures its greenhouse gas emissions and takes immediate action to curtail activities that cause increased emissions, that we will indeed affect climate change for the better. University City aspires to be the leader in community sustainability and as such should set the protocol in the actions it takes to reduce the community's carbon footprint. The first step is to measure exactly where we are through a greenhouse gas inventory. The baseline of data will inform policy, decisions and actions taken by the City and the community. As an example, Creve Coeur performed their greenhouse gas inventory and found, to their surprise, that much of the traffic related emissions are not from its three major thoroughfares (I-270, Lindbergh and Olive), but from the 99 miles of collector streets. Without this information, the City of Creve Coeur may have approached their plan for the reduction of greenhouse gas emissions in a completely different manner.

Major Findings

Community Emissions Inventory

In the year 2005, the community of University City emitted approximately *514,363 metric tons of* CO_2e. As shown in Table 1, and Figure 1 below, the Residential sector was the largest emitter, producing approximately 44.8 percent of the total community emissions in 2005. The transportation and commercial sectors were the next largest emitters, accounting for approximately 31.6 and 18.0 percent of the total community emissions, respectively.

All of the residential emissions come from the consumption of natural gas usage at residences within the University City boundaries and from the consumption of electricity that is generated (by AmerenUE) outside of University City, but is used within city limits. The majority of the community's transportation emissions are the result of gasoline consumption in privately-owned vehicles traveling on local roads and interstate I-170.

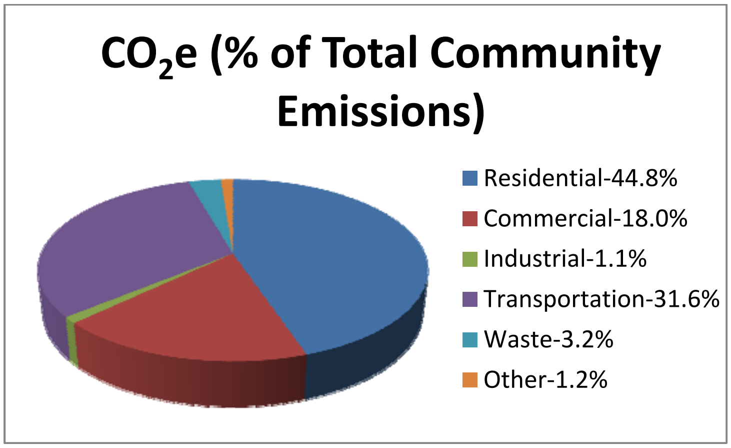
The transportation sector was the largest energy user; using approximately *2,280,223 MMBtu's* in 2005. The Residential sector was the second largest energy user; using approximately *2,163,383 MMBtu's* in 2005.

Please refer to the Community Emissions Inventory on page 14, for more information.

Table 1: *Summary Report of Community GHG Emissions by Sector, 2005*

Sector	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)
Residential	234,101	2,696	9,444	235,136	44.8	2,163,383
Commercial	93,976	1,311	2,512	94,435	18.0	640,540
Industrial	5,789	74	78	5,814	1.1	45,694
Transportation	162,438	10,170	8,144	165,762	31.6	2,280,223
Waste[i]	0	0	794,648	13,216	3.2	N/A[ii]
Other	6,453	30	0	6,453	1.2	N/A[ii]
Total	502,757	14,252	814,826	514,363	100.0	5,129,840

Figure 1: *Graph of Community GHG Emissions by Sector, 2005*[i]



Government Operations Emissions Inventory

The City of University City's government operations emitted approximately *7,484 metric tons of CO_2e* in the year 2005. These municipal emissions constituted approximately 1.43 percent of the community's total GHG emissions. "This is not unusual, local governments typically account for approximately *two percent* of community levels."[iii]

While the municipal operations only constitute a minor contributor to the city's total emissions, the local government is in the best position to encourage community-wide GHG emissions reductions through "leading by example".

Figure 2: *Graph of 2005 Government Operations GHG Emissions by Sector*

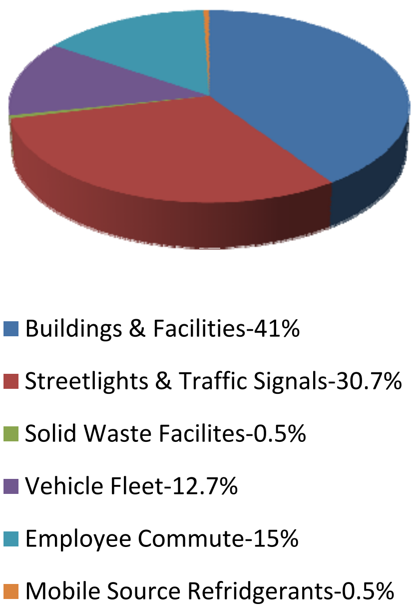


Table 2: *Summary Report of Government GHG Emissions, 2005*

Subsectors	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy Use (MMBtu)	Cost ($)
Buildings & Facilities	3,016	42	82	3,031	40.5	20,738	300,174
Streetlights & Traffic Signals	2,284	38	26	2,296	30.7	9,387	562,669

Solid Waste Facilities	40	1	0	40	0.5	165	3,107
Vehicle Fleet	943	28	23	952	12.7	21,077	382,209
Employee Commute	1,103	66	55	1,124	15	15,506	275,054
Other Process Fugitive	0	0	0	0	0	0	0
Mobile Source Refrigerants	0	0	0	40	0.5	0	0
Total	7,386	174	187	7,484	100	66,873	1,523,213

As shown in Figure 2 and Table 2 (above), the largest emitting sector within University City's municipal operations were the city owned buildings and facilities, accounting for approximately *40.5 percent* of the total government operations in 2005. Emissions from these buildings and facilities result from the consumption of electricity and natural gas. The city's streetlights, traffic signals, and other outdoor lighting accounted for approximately *30.7 percent* of the government's emissions. The city's streetlights, traffic signals, and other outdoor lighting sector was the most expensive sector by a significant margin.

Climate Change Background[iv]

The warmth of the earth is a natural phenomenon of our planet. Global warming is caused by large amounts of greenhouse gases made up of carbon dioxide and methane being trapped in the earth's atmosphere. Emissions from carbon dioxide are produced whenever fossil fuels are burned (oil, natural gas, gasoline, diesel fuel and coal). As result of even a slight increase of global temperature, major changes in climate patterns have been emerging, including extreme weather events (such as Hurricane Ike and other major flood inducing storm activity). Methane (or CH_4) is a byproduct of organic waste and sewage decomposition. Organic waste is made up of paper, yard trimmings, wood and food waste as it decomposes in landfills. Sewer treatment plants are a significant source of methane, which is 21 times more powerful per unit than CO_2 in its greenhouse effect.

There is scientific evidence that human activity during the 20th and 21st centuries has caused the earth to warm at an alarmingly accelerated pace that threatens our very existence. Overwhelming scientific evidence shows that the manner in which human society is currently living is unsustainable. We are significantly changing our climate; we are exacerbating many human and environmental health issues; we are rapidly depleting non-renewable resources; we are driving species to extinction; and we are jeopardizing the planet for future generations. In response to this, there has been a global paradigm shift underway for more than a decade to respond to and correct the human course to live sustainably.

These issues are the most critical facing humans; they directly challenge survival and life on this planet. While these challenges and many of the solutions are global in nature, our success will start with and rely on collective efforts and successes at local, regional, and national levels. Therefore many communities in the United States are taking responsibility for addressing climate change at a local level. The community of University City has acknowledged the impact of humans on the environment and is striving to live out the motto, *Think Globally, Act Locally*.

The Cities for Climate Protection Campaign[v]

By adopting a resolution committing the city to locally advancing climate protection, University City has joined an international movement of local governments. More than 1000 local governments have joined ICLEI's Cities for Climate Protection (CCP) campaign.

The CCP provides a framework for local communities to identify and reduce greenhouse gas emissions, organized along five milestones:

(1) Conduct an inventory of local greenhouse gas emissions;
(2) Establish a greenhouse gas emissions reduction target;
(3) Develop a climate action plan for achieving the emissions reduction target;
(4) Implement the climate action plan; and,
(5) Re-inventory emissions to monitor and report on progress.

This report marks the completion of the first CCP milestone, and provides a foundation for future work to reduce greenhouse gas emissions in University City.

Sustainability and Climate Change Mitigation in University City[vi]

A bustling St. Louis County suburb of almost 40,000, U. City is one of the latest examples of a nationwide movement of local governments committing to make environmental issues a priority. In 2005, University City signed the U.S. Conference of Mayors' Climate Protection Agreement. The program was launched to urge mayors to pledge to protect the climate and is currently the only climate protection agreement of its kind among U.S. elected officials. By signing the agreement, mayors pledged to reduce carbon dioxide emissions by 7 percent below 1990 levels by 2012. University City is one of 19 cities in Missouri that has signed the agreement. University City's signature demonstrates its commitment to be at the forefront of municipal government green initiatives in code enforcement, recycling and energy saving measures.

In addition to its pledge to reduce carbon dioxide emissions by the measure set forth in the U.S. Mayor's Climate Protection Agreement, University City has initiated several green initiatives and best practices University City established a single-stream recycling program which has significantly improved the city's recycling rates since its inception. The program involved the distribution of wheeled, recycling containers in which citizens could place all recyclables in one large container and wheel to the curb for collection. Additionally, the City has switched to lower-energy traffic lights and has made its 100 year old City Hall building more energy efficient. In 2008, the City Hall building in University City became the only municipal building in the St. Louis metropolitan area to have received LEED Certification by the U.S. Green Building Council. The sustainable renovation of the City Hall building, which was originally built in 1904, was a formidable stride in the city's desire to "lead by example". The renovation of the City Hall building included the installation of bicycle storage and rider changing rooms, improved access to public transportation, ADA compliant transportation parking capacity, storage and collection of recyclables, building reuse maintaining 100% of existing shell and low emitting materials for paints, carpets and composite wood.

The most significant green initiative was the formation of a Green Practices Committee (GPC) and the drafting of a city-wide, comprehensive climate change action plan aimed to reduce waste generation and carbon emissions. The University City GPC was officially established in 2008 under the direction of City Manager Julie Feier and Mayor Joe Adams with the goal of developing a comprehensive strategic plan that would guide the city to become sustainable at the municipal, residential, institutional and commercial levels. The City Council agreed that "this elected body will act to provide leadership, guidance and immediate action." It is the mission of the GPC to encourage sustainable practices and programs that improve the health and quality of life of our community; protect and restore its natural resources, and strengthen our economy. It is the GPC's vision to have a fully engaged community that integrates sustainability into every decision made, and every action taken by city government, citizens, employees, business owners, students, and patrons. The GPC aspires to develop University City into the leader in community sustainability and as such, a practical model for other municipalities and businesses. Altogether, University City seeks to "lead by example", demonstrating that local governments can realize increased energy savings, environmental health and economic benefits by implementing "green" best practices.

University City's GPC finalized a city-wide sustainability strategic plan on September 7, 2009. The drafted plan, Resolution 2009-18 was officially passed by City Council on September 21, 2009 (See APPENDIX B). The Sustainability Strategic Plan is divided into seven key areas: Ecosystems/Habitat; Water/Storm water; Air Quality/Transportation; Waste/Resource Conservation; Land Use/Open Space/Parks; Energy; and Green Buildings. Within the report, the GPC included a description along with specific goals and action items to be addressed by the city in accordance with Resolution 2009-18, "Resolution of the City of University City for Community Sustainability".

In addition to the information provided for these seven key areas, the Sustainability Strategic Plan also contains the five "first steps" approved by City Council:

1.) Greenhouse Gas Emissions Inventory
2.) Energy Audits of City facilities
3.) Sustainable design guidelines and expected return on investment for projects
4.) Street lighting analysis
5.) Revise Building and Zoning codes to align with green practices

The completion of this Greenhouse Gas Emissions Inventory marks the accomplishment of the GPC's first goal to quantitatively assess the city's current and future environmental performance. The baseline data provided in this report will allow the City to begin to make changes and measure its success.

City of University City 2010-2011 Greenhouse Gas Emissions Inventory

The first step toward reducing greenhouse gas emissions and developing a more sustainable community is to identify baseline levels and sources of emissions. In concordance with ICLEI's Cities for Climate Protection Milestone Guide (CCP), "the first milestone is to conduct a Greenhouse Gas Emissions Analysis: Baseline Inventory and Forecast." [vi] The emissions baseline and forecast provides an important "benchmark" as well as the insight necessary for University City to fulfill the goals set forth in its strategic plan for sustainability.

Methods[iv]

ICLEI's Cities for Climate Protection assists local governments in systematically tracking energy and waste related activities within their jurisdiction, and in calculating the relative quantities of greenhouse gases produced by each activity and sector. The greenhouse gas inventory protocol involves performing two assessments: a community wide assessment and a separate inventory of municipal facilities and activities. The municipal inventory is a subset of the community inventory.

CACP Software[iv]

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) software package in partnership with the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO), and Torrie Smith Associates. This software calculates emissions resulting from energy consumption and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. CACP aggregates and reports the three main greenhouse gas emissions (CO_2, CH_4, and N_2O) in terms of equivalent carbon dioxide units, or CO_2e. Converting all emissions to equivalent carbon dioxide units allows for consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat, so the CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents. The CACP software is also capable of reporting input and output data in several formats, including detailed, aggregate, source-based, and time-series reports.

The emissions coefficients and quantification method employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA from1605).

The CACP software has been and continues to be used by over 300 U.S. cities, towns, and counties to reduce their greenhouse gas emissions. However, it is worth noting that, although the software provides University City with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation of reality, rather than an exact value.

Creating the Inventory

Creating this emissions inventory required the collection of information from a variety of sources including: AmerenUE, East-West Gateway Council, Laclede Gas, Missouri American Water and the City of University City staff. Data from the year 2005 was used to perform both the community and municipal assessments. One of the first major steps of the inventory was to define each assessment's organizational boundaries, in terms of the operations that the local government owns and controls, and the community's operational boundaries as a whole. The municipal inventory is effectively a subset of the community-scale inventory (the two are not mutually exclusive).[iii] Upon making this distinction, emissions are categorized as direct or indirect and then further classified by the scope of accounting and reporting. The Local Government Operations Protocol, developed by ICLEI to serve as the primary manual for GHG emissions inventories, recommends dividing GHG emissions by the following scopes in order to improve transparency and to provide utility for different types of climate policies and goals[v]:

Scope 1[v] - All direct GHG emissions. Direct emissions are emissions from sources within the local government's organizational boundaries that the local government owns or controls (i.e. emissions from sources within University City's city limits). Scope 1 emissions are further subdivided into emissions resulting from four (4) separate types of sources:

- **Stationary combustion [emissions]** of fuels to produce electricity, steam, heat, or power using equipment in a fixed location.
- **Mobile combustion [emissions]** of fuels in fleet transportation sources and off-road equipment.
- **Process emissions** from physical or chemical processing, other than fuel combustion; and
- **Fugitive emissions** that are not physically controlled, but result from intentional or unintentional releases, commonly arising from the production, processing, transmission, storage, and use of fuels and other substances, often through joints, seals, packing, gaskets, etc.

Scope 2[v] **-** Indirect emissions resulting from the consumption of purchased or acquired electricity, steam, heating and cooling. Indirect GHG emissions are a consequence of activities that take place within the organizational boundaries of the entity, but that occur at the sources owned or controlled by another entity. Scope 2 emissions physically occur at the facility where electricity in generated.

Scope 3/Informational Item(s)[v] - Includes all indirect emissions not covered in Scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by local government (e.g. employee commuting and business travel), outsourced activities, waste disposal, etc. Local governments are encouraged to identify and measure all Scope 3 emission sources to the extent possible; however, reporting of Scope 3 emissions is optional. Essentially, these emissions were deemed important enough to mention; however, for one reason or another, the measurement/calculation of these emissions may subsequently contain a significant amount of error. As a result, these items are categorized as informational items, meaning they are present, but they are not included in the calculation of all emissions. Electricity generated and used to treat and pump water is an example of a Scope 3 emissions.

Double Counting[v]:
One of the most important reasons for using the scopes framework for reporting greenhouse gas emissions at the local level is to prevent “double counting” for major categories such as electricity use and waste disposal. Double counting occurs if a set of emissions could be considered twice within an inventory. For example, if a local government produced its own power, it would be considered a Scope 1 emission at the point of generation and a Scope 2 emission at the point of consumption, and it would be inappropriate to add these emissions together.

Inventory Results

Community Emissions Inventory

This inventory includes Scope 1, Scope 2 and Scope 3 sources from the following sectors:

- Residential
- Commercial/Industrial[vii]
- Transportation
- Waste
- Wastewater Facilities
- Water Delivery Facilities

Table 3: *Community Inventory Emissions Sources by Scope and Sector*

Sector	Scope 1	Scope 2	Scope 3
Residential	*Natural Gas*	*Electricity*	
Commercial/Industrial	*Natural Gas*	*Electricity*	
Transportation	*Gasoline & Diesel*		
Waste			*Methane from Waste*
Wastewater Facilities			*Electricity*
Water Delivery Facilities			*Electricity*

Table 4: *Community GHG Emissions per Sector per Scope (metric tons of CO_2e):*

Sector	Scope 1	Scope 2	Scope 3	Total
Residential	81,717	153,419		235,136
Commercial/Industrial	18,786	81,463		100,249
Transportation	165,762			165,762
Waste			13,216	13,216
Total[viii]	266,265	234,882	13,216	514,363
% of Total CO_2e	51.8%	45.7%	2.6%	100.1%[ix]

Table 5: *Community Scope 1 GHG Emissions (metric tons CO_2e)*

Sector	CO_2e (metric tons)	Percentage of Total CO_2e	MMBtu
Residential	81,717	30.8%	1,536,148
Commercial/ Industrial	18,786	7.1%	353,180
Transportation	165,172	62.2%	2,280,223
TOTAL	265,675	100.1%	4,169,551

Table 6: *Community Scope 2 GHG Emissions*

Sector	CO_2e (metric tons)	Percentage of Total CO_2e	MMBtu
Residential	153,419	65.3%	627,235
Commercial/ Industrial	81,463	34.7%	333,054
TOTAL	234,882	100.0%	960,289

Figure 3: *Community Scope 1 Emissions*

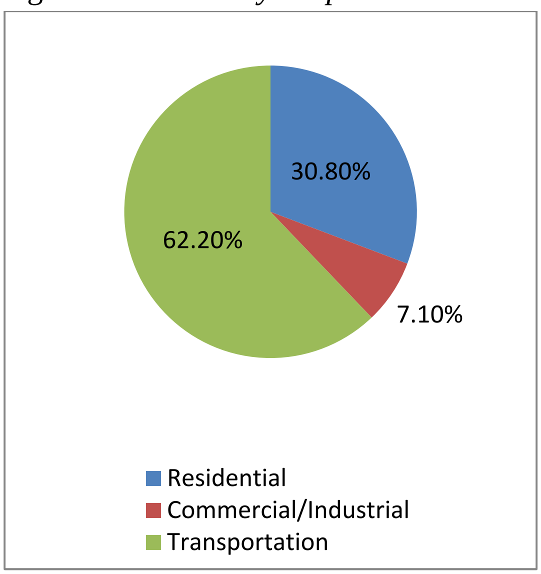
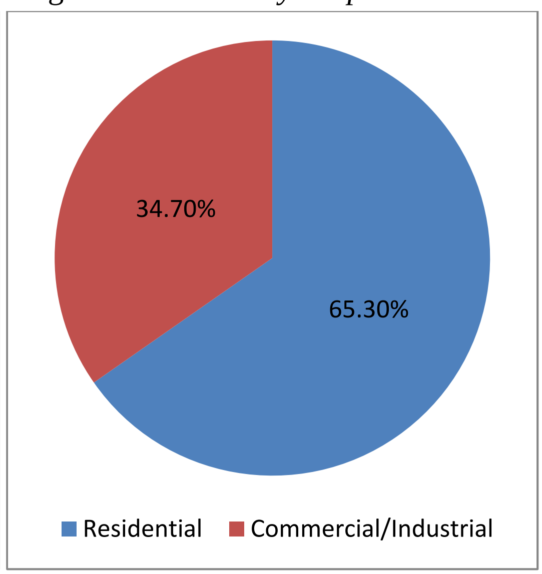


Figure 4: *Community Scope 2 Emissions*



Figures 3 and 4 above provide a graphical perspective of University City's Community Scope 1 (natural gas usage) and Scope 2 (electricity usage) emissions. As seen in Figure 3, the largest percentage (*62.2%*) of Scope 1 emissions was generated by the Transportation sector. The remainder of the emissions included in the City of University City's 2005 community inventory fall under the category of Scope 3 emissions (Information Items).

All-Scope Emissions by Sector

As previously noted in the executive summary, the community of University City, across all scopes, emitted approximately *524,286 metric tons of CO_2e in the year 2005.* In addition to viewing this data through the lens of various scopes, we can also focus specifically on each sector, with scopes aggregated by sector.[iii]

Figure 5: *Community All-Scope Emissions by Sector, 2005*.

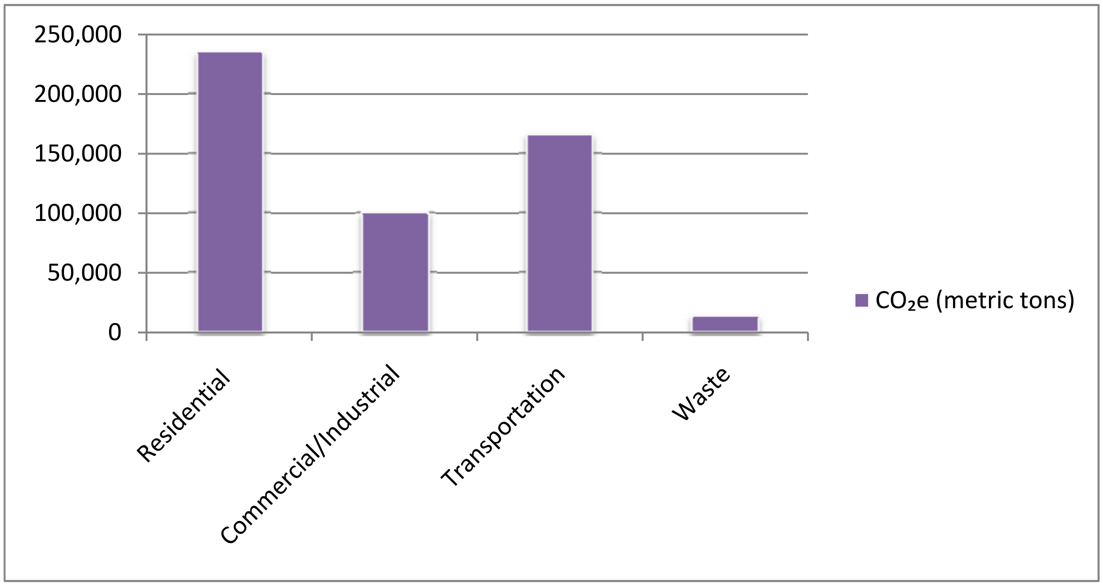
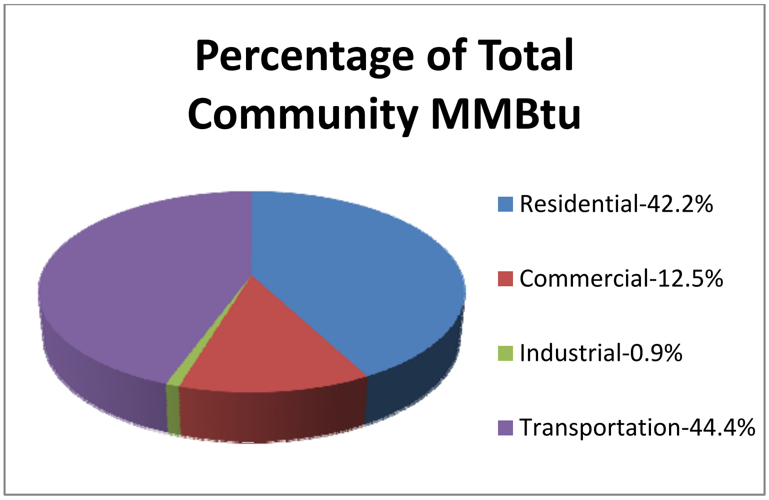


Figure 6: *2005 Community Energy Use*



Built Community Infrastructure (Residential, Commercial, and Industrial):

During the *calendar year of 2005*, University City's residential, commercial, and industrial sectors (referred to as built community infrastructure) combined to emit *approximately 335,384 metric tons of CO_2e*. Collectively, these three sectors comprised *approximately 63.9 percent* of the community's total emissions in 2005. By examining Table 7, one can see that University City's residential sector was the largest emitter of the three, followed by the commercial and industrial sectors, respectively. All of the emissions that are being calculated from the built community infrastructure are the result of local natural gas consumption (Scope 1) and local consumption of electricity that is being generated outside of University City (Scope 2).

Table 7: *Built Community Infrastructure Emissions by Sector, 2005*

Sector	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)
Residential	234,101	2,696	9,444	235,135	44.8	2,163,383
Commercial	93,976	1,311	2,512	94,435	18.0	640,540
Industrial	5,789	74	78	5,814	1.1	45,694
TOTAL	333,866	4,081	12,034	335,384	63.9	2,849,617

Table 8: *Built Community Infrastructure Energy Use by Sector, 2005*

Sector	Electricity (kWh)	Natural Gas (therms)
Residential	182,005,970	15,361,483.2
Commercial	91,510,736	3,251,732.0
Industrial	5,132,142	280,074.6
TOTAL	278,648,848	18,893,289.8

Residential Sector Detailed Report:

Table 9: *2005 Residential Community GHG Emissions Data*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)
Electricity Usage	152,593	2,543	1,763	153,419	29.3	627,235
Natural Gas Usage	81,508	154	7,681	81,717	15.6	1,536,148
Subtotal Residential	234,101	2,696	9,444	235,135	44.8	2,163,383

Commercial Sector Detailed Report:

Table 10: *2005 Commercial Community GHG Emissions Data*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)
Electricity Usage	76,722	1,278	886	77,137	14.7	315,367
Natural Gas Usage	17,254	33	1,626	17,298	3.3	325,173
Subtotal Commercial	93,976	1,311	2,512	94,435	18.0	640,540

Industrial Sector Detailed Report:

Table 11: *2005 Industrial Community GHG Emissions Data*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)
Electricity Usage	4,303	72	50	4,326	0.8	17,687
Natural Gas Usage	1,486	3	28	1,488	0.3	28,007
Subtotal Industrial	5,789	74	78	5,814	1.1	45,694

Figure 7: *2005 Residential GHG Emissions by Consumption Type*

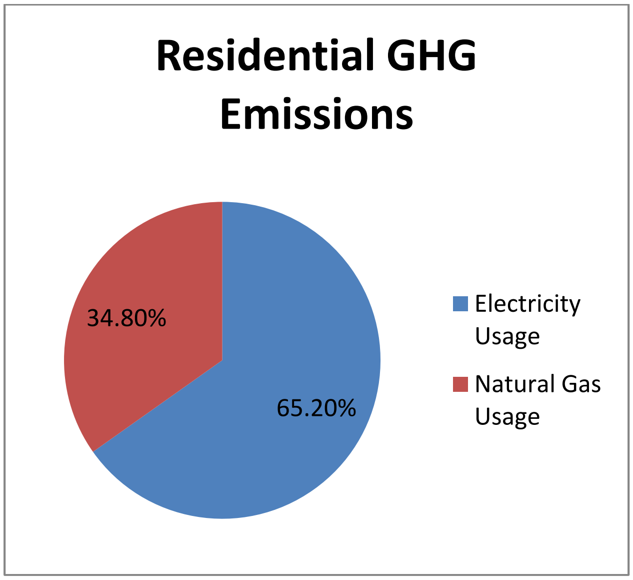
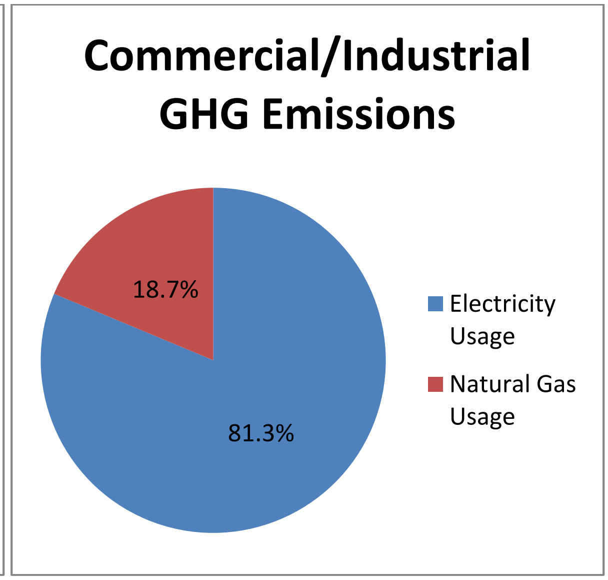


Figure 8: *2005 Commercial/Industrial GHG Emissions by Consumption Type*



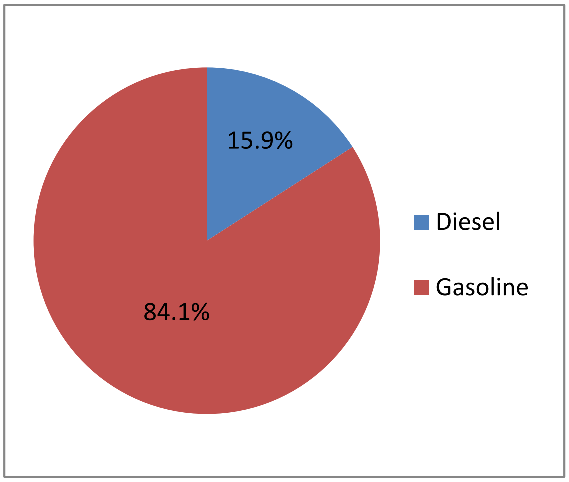
Transportation:

The transportation sector inventories community emissions based on the number of vehicle-miles-traveled (VMT) on the highways and roads inside of University City's boundaries during a given year. In 2005, University City's transportation sector contributed *approximately 165,172 metric tons of CO_2e*. Overall, the transportation sector accounted *for approximately 31.6% of the community's total GHG emissions in 2005*.

Table 12: *Community Transportation GHG Emissions by Fuel Source, 2005*

Fuel Type	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)
Diesel	26,286	77	80	26,311	5.0	359,340
Gasoline	136,152	10,093	8,064	139,450	26.6	1,920,883
Subtotal Transportation	162,438	10,170	8,144	165,762	31.6	2,280,223

Figure 9: *Transportation GHG Emissions by Fuel Type, 2005*



Waste:

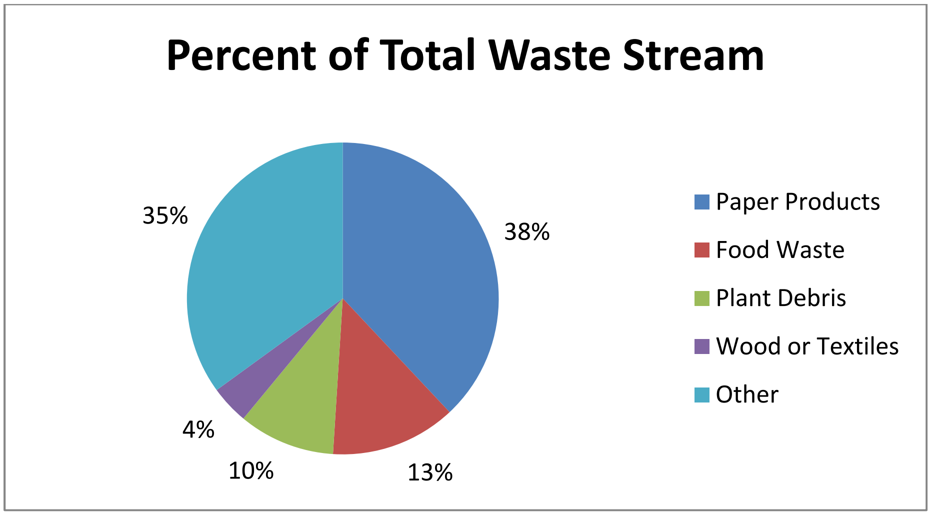
Managed Landfill Waste:

In 2003[x], University City produced 14,889 metric tons of waste which in turn resulting in approximately *13,709 metric tons of CO_2e*. GHG emissions from waste occur during the breakdown of organic waste in landfills. The primary GHG released from landfills is methane, which is twenty-one times more efficient at trapping heat than CO_2. These emissions are considered to be Scope 3 emissions because they are not generated in the base year, but will result from the decomposition of the 2003 waste over the full 100+ year cycle of its decomposition. Paper products constitute the largest percentage of GHG emissions from waste, with food waste being the second largest emitter.

Table 13: *2005 Landfill Community GHG Emissions*[xi]

	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)
Paper Products	481,201	10,105	1.9
Food Waste	93,182	1,957	0.4
Plant Debris	40,618	853	0.2
Wood or Textiles	14,336	301	0.1
All Other Waste	0	0	0.0
Subtotal Landfill	629,337	13,216	2.5

Figure 10: *Community Managed Landfill Waste GHG Emissions by Waste Type*[xii]



Composted Waste[xiii]:

Table 14 (below) shows the amount of community waste that was composted in 2005. In theory, composted waste represents a GHG emissions reduction because it is waste that was never transported to and decomposed in a landfill. As a result, composted waste appears as a negative value. Apart from the reduced volume in the waste material, composting stabilizes this waste and destroys the pathogens in the waste material. Despite the appearance of composted waste as a reduction, the data in this subsector is categorized as Scope 3 emissions, which means that it is not included in the community emissions total.

Table 14: *Community Composted Waste by Waste Type, 2005*[xiii]

Waste Type	**GHG Emissions Reduction (metric tons CO_2e)**
Plant Debris	-940
Wood or Textiles	-13,986
TOTAL	-14,926

Recycled Waste[xiii]:

As was the case with composted waste, recycled materials also represent a GHG emissions reduction. University City was also able to recycle and therefore divert approximately *2,428 tons of waste* from decomposing in a landfill. As a result, the community reduced its 2005 waste emissions by approximately *13,472 metric tons of CO_2e*. Recycling is an important environmental practice that helps decrease GHG emissions and prevents the financial cost and land needed for land-filling.

Table 15: *Community Recycled Waste by Waste Type, 2005*[xiii]

Waste Type	GHG Emissions Reduction (metric tons CO_2e)	Amount of Waste Recycled (metric tons)
Paper Products	-2,548	1,782
Wood or Textiles	-38	27
All Other Waste	-885	619
TOTAL	-13,472	2,428

"Other" Emissions Sectors

Water Treatment Facilities:

In 2005, the water treatment facilities responsible for treating University City's waste water emitted approximately *4,213 metric tons of CO_2e*. It is important to note that GHG emissions resulting from the treatment of waste water are listed as an information item (Scope 3 emissions) and are therefore not included in the summation of the community's total emissions. Bruce Litzsinger of the Metropolitan Sewer District (MSD) provided a per capita value for the volume of waste water treated which can be translated into a per capita GHG emissions value based on internal carbon footprint data. This per capita, waste water emissions value was then multiplied by University City's population (32,885) to achieve the total community-wide emissions for that year.

Water Delivery Facilities:

The Missouri American Water central plant is responsible for transporting the water supply to the citizens of University City. GHG emissions resulting from these water delivery facilities are a product of the electricity used to pump water from the central plant to the University City community. Bob Fuerman, Production Director of Missouri American Water, provided the central plant's total electricity usage and population served for the 2005 calendar year. This data was then converted into a total value specific to the University City community. In 2005, the water delivery facilities serving University City emitted approximately *2,240 metric tons of CO_2e*. Similar to the water treatment facilities, emissions resulting from the electricity used to deliver water supply are categorized as an "information item" and as such are not included in the community's total emissions value.

Table 16: *"Other" Community GHG Emissions by Sector, 2005*

"Other" Emissions Sectors	GHG Emissions (metric tons of CO_2e)	Percentage of Total Community Emissions (%)
Wastewater Facilities	4,213	0.08
Water Delivery Facilities	2,240	0.04

Per Capita Emissions

Per capita emissions can be a useful metric for measuring progress in reducing greenhouse gases and for comparing one community's emissions with neighboring cities and against regional and national averages. Currently it is difficult to make meaningful comparisons between cities because of variation in the scope of inventories conducted, but this will be possible in the near future when a universal reporting standard is completed and adopted through a process driven by ICLEI[iii].

Dividing the 2005 total community GHG emissions by population[xiv] yields a result of *approximately 15.64*[xv] *metric tons CO_2e per capita per year*. It is important to reiterate that the per capita emissions number for University City is not directly comparable to every per capita number produced by other emissions studies because of differences in emission inventory methods. As a general comparison, the World Bank estimated the 2005 U.S. per capita CO_2e emissions at approximately *19.7 metric tons per capita*[xvi].

2005 Community Emissions Forecast

The community emissions forecast was performed using an energy forecast tool provided by ICLEI. This tool uses data from the U.S. Department of Energy, Energy Information Association and community growth rates provided by the East-West Gateway Council of Governments to calculate the growth in energy use. *Under a business-as-usual scenario*, a situation where no GHG emissions reduction measures are implemented, *University City's emissions are expected to remain nearly the same over the next decade and a half.* To illustrate this projected trend in future in energy use, driving habits, job growth, and population growth from the baseline year going forward, the author conducted an emissions forecast for the year 2020.

Table 17: *Community Forecast Growth Factors*[xvii]

Sector	2008-2020 Growth Rates
Residential	0.0%
Commercial/ Industrial	1.0%
Transportation	0.6%
Waste	0.0%

Figure 11: *Community Emissions Forecast*

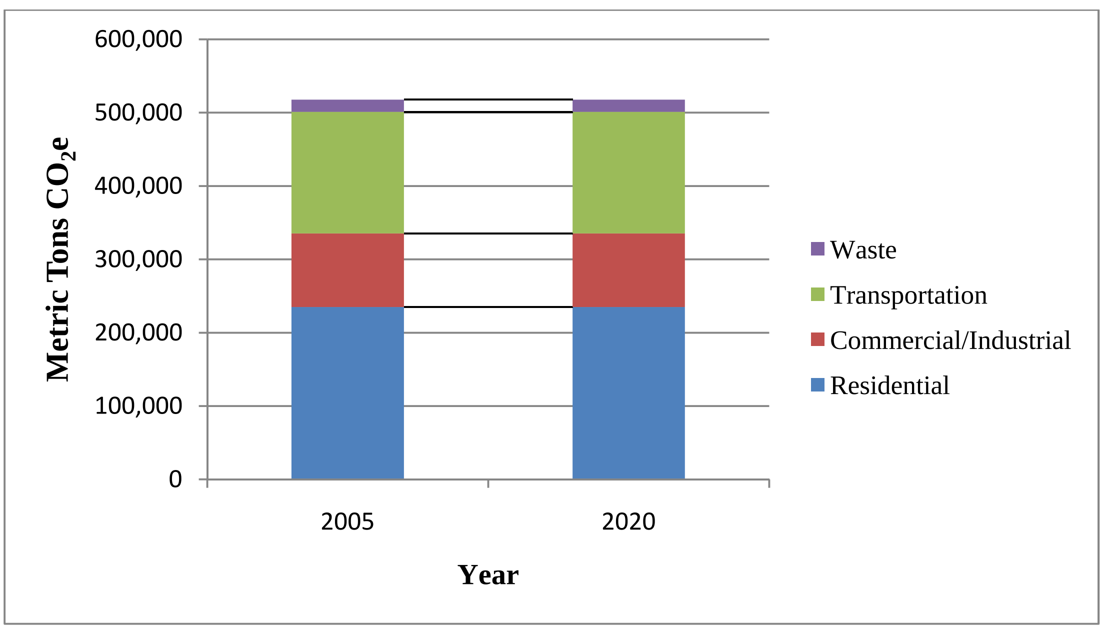


Table 18: *Community Emissions Growth Projections by Sector*

Community Emissions Growth Forecast by Sector	2005	2020
Residential	235,135	235,121
Commercial/ Industrial	95,019	100,241
Transportation	165,762	165,766
Waste	16,688	16,688
TOTAL	524,286	524,269

Residential:

The projected change in GHG emissions for the residential sector was calculated by a population projection for University City between 2010 and 2020. This projection, which was conducted by the East-West Gateway Council of Governments, expects *0.0% growth* in the residential sector. It is important to realize that this growth projection is indeed an approximation and as such presents certain limitations; however, this projection does seem plausible given the suburban location of University City, and consequently it's corresponding inability to spatially grow.

Commercial/Industrial:

The projected change in both the community's commercial and industrial sectors was determined by estimating the annual percent change in the number of jobs in each of these sectors. As with the other sectors, the commercial and industrial sectors are expected to expand at a very slow rate, if at all. The East-West Gateway Council of Governments projects a *1.0% growth rate* between 2008 and 2020.

Transportation:

For the transportation sector, projected growth in energy demand and GHG emissions was obtained from a traffic volume report developed by the East-West Gateway Council of Governments[xviii]. This comprehensive report features actual VMT growth data from 1998-2005. The projection developed from this report predicts a *0.6% increase* in the vehicle-miles-traveled (VMT) between 2008 and 2020.

Waste:
As with the residential sector, the primary determinate for growth in waste sector emissions is population. Therefore, the average annual population growth rate, *0.0%*, was used to estimate future emissions resulting from the waste sector.

2005 Government Operations Emissions Inventory

The framework of scopes discussed in the Community Emissions Inventory equally applies to the Government Operations Emissions Inventory. The sources of emissions that are being counted in Scope 1 and 2 of the Government Inventory are facilities and equipment owned and operated by the City. The Information Items of the Government Operations Inventory are generally lifecycle emissions sources (such as the decomposition of waste), and emissions sources that the City does not own, but may exhibit significant influence over (such as employee commute patterns). The Government Operations Inventory includes Scope 1, Scope 2, and Scope 3 emissions from the following sectors[iii]:

- Buildings & Facilities
- Streetlights & Traffic Signals
- Solid Waste Facilities
- Vehicle Fleet
- Employee Commute
- Other Process Fugitive Sources
- Mobile Source Refrigerants

Table 19: *Government Operations Emissions Sources by Scope and Sector*

Sector	Scope 1	Scope 2	Scope 3
Buildings & Facilities	*Natural Gas*	*Electricity*	
Streetlights & Traffic Signals		*Electricity*	
Solid Waste Facilities			*Methane from Decomposition*
Vehicle Fleet	*Gasoline & Diesel*		
Employee Commute			*Employee Commute*
Other Process Fugitive Sources			*Use of Fire Extinguishers*
Mobile Source Refrigerants			*AC used in Vehicle Fleet*

Table 20: *Summary Report of Government GHG Emissions, 2005*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)[xix]	CO_2e (%)	(MMBtu)	Cost ($)
Buildings & Facilities	3,016	42	82	3,030	40.5%	20,738	300,174
Streetlights & Traffic Signals	2,284	38	26	2,296	30.7%	9,387	562,669
Solid Waste Facilities	40l	1	0	40	0.5%	165	3,107
Vehicle Fleet	943	32	37	954	12.7%	21,077	382,209
Employee Commute	1,108	66	55	1,129	15.1%	15,575	278,884
Other Process Fugitive	0	0	0	40	0.5%	0	0
Mobile Source Refrigerants	0	0	0	0	0.0%	0	0
TOTAL	7,391	178	201	7,491	100.0%	66,943	1,527,043

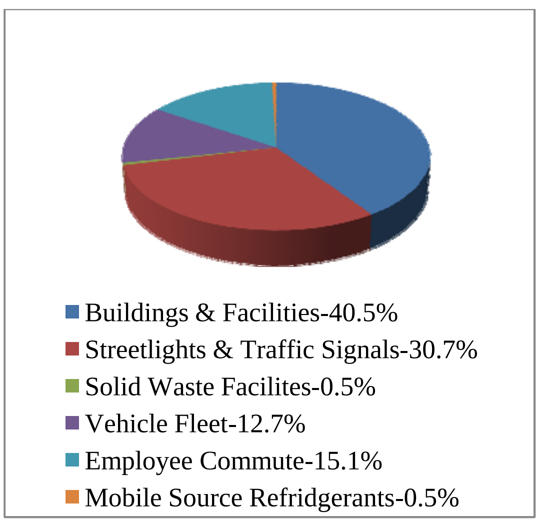


Figure 12: *CO_2e*
(% of Total Government Emissions)

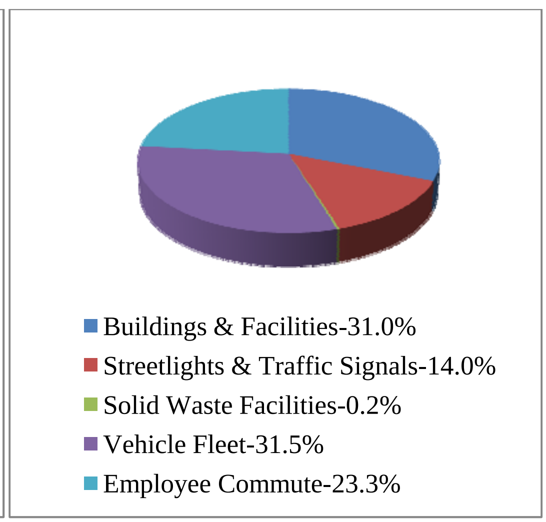


Figure 13: *Energy Use*
(% of Total MMBtu)

Careful observation of the 2005 GHG emissions data for University City's government operations, summarized in Table 20 above, shows that municipally-owned buildings and facilities were the largest contributing GHG emitters. Although this sector accounted for the largest amount of CO_2e emissions, University City's "Streetlights and Traffic Signals" sector was the second largest emitter as well as the most costly energy user. It is also important to note that while the city's vehicle fleet only accounted for approximately *12.7 percent of the government's GHG emissions in 2005*, it was the largest user of energy at *21,077 MMBtu's* for the year. The following figures provide a much more in-depth analysis for government emissions in 2005 by further categorizing each sector into subsectors.

Buildings & Facilities Sector Detailed Report

The "Buildings and Facilities" sector is comprised of all facilities owned and operated by the City of University City. Emissions resulting from these facilities originate from the consumption of electricity and natural gas. Table 21 (below) depicts the Scope 1 Buildings and Facilities emissions data, which results from the use of natural gas in these facilities. Collectively, Scope 1 emissions from municipally-owned structures totaled approximately *567 metric tons of CO_2e in 2005*. Comparatively, the Scope 2 Buildings and Facilities emissions totaled *approximately 2,464 metric tons of CO_2e in 2005*. Tables 21 and 22 show that the largest emitting government facilities are city hall, the library, the recreation center/swimming pool, and the city hall annex, respectively[xx]. Table 23 provides energy (MBtu) on a per square foot basis (thousands of BTU per square foot). This data helps analyze the energy efficiency of the building. Give the largest per capita energy users.

Table 21: *Buildings & Facilities Scope 1 GHG Emissions (Natural gas usage), 2005*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	(MMBtu)	Cost ($)
Central Garage	109	0	10	109	1.5	2,050	27,146
City Hall	148	0	14	149	2.0	2,794	29,638
City Hall Annex	16	0	1	16	0.2	295	4,030
Community Center	36	0	3	36	0.5	682	7,573
Fire Station 2	33	0	3	33	0.4	629	7,311
Library	58	0	5	58	0.8	1,093	12,333
Parks Maintenance Shop	31	0	3	31	0.4	588	5,468
PW Sign Shop	22	0	2	22	0.3	417	4,419

Ruth Park Golf Maintenance Shop	11	0	1	11	0.1	203	2,413
Ruth Park Golf Pro-shop	8	0	1	8	0.1	152	1,858
Swimming Pool/ Rec Center	83	0	8	83	1.1	1,556	16,725
The Green Center	10	0	1	10	0.1	189	2,550
***Scope 1* Subtotal**	**565**	***1**	**53**	**566**	**7.6**	**10,648**	**121,465**

Table 22: *2005 Buildings & Facilities Scope 2 GHG Emissions (Electricity usage)*

	CO_2 (metric tons)	**N_2O (kg)**	**CH_4 (kg)**	**CO_2e (metric tons)**	**CO_2e (%)**	**(MMBtu)**	**Cost ($)**
Central Garage	103	2	1	104	1.4	425	8,593
City Hall	620	10	7	624	8.3	2,550	41,508
City Hall Annex & Trinity Building	342	6	4	344	4.6	1,406	24,642
Community Center	117	2	1	118	1.6	481	9,730
Delmar Loop Parking Garage	128	2	1	129	1.7	526	7,921
Fire Station 2	74	1	1	75	1.0	306	6,548
Fogerty Park Pavilion	1	0	0	1	0.0	6	199
Heman Park Pavilion	0	0	0	0	0.0	2	136
Library	479	8	6	482	6.4	1,970	35,768
Millar Park Pavilion	2	0	0	2	0.0	9	255
Parks Maintenance Shop	37	1	0	37	0.5	150	2,624
PW Sign Shop	12	0	0	12	0.2	49	1,051
Ruth Park Golf Maintenance Shop	10	0	0	10	0.1	43	828

Ruth Park Golf Pro-shop	60	1	1	60	0.8	246	5,169
Ruth Park Pump House	12	0	0	12	0.2	48	1,150
Swimming Pool/ Rec Center	438	7	5	440	5.9	1,800	31,037
The Green Center	13	0	0	13	0.2	54	1,092
***Scope 2* Subtotal**	2,450	41	28	2,464	32.9	10,072	178,251

Table 23: *2005 Buildings & Facilities Total GHG Emissions (Scope 1 & 2)*

	CO_2e (metric tons)	**CO_2e[xxi] (%)**	**Energy (MBtu)**	**Square Footage[xxii]**	**Energy per Sq. Ft. (MBtu/sq. ft)**	**Energy Cost ($)**
Central Garage	213	7.0%	2,475	14,075	0.1758	35,739
City Hall	773	25.5%	5,344	32,900	0.1624	71,146
City Hall Annex & Trinity Building	360	11.9%	1,701	64,800	0.0263	28,672
Community Center	154	5.1%	1,163	9,047	0.0001	17,303
Delmar Loop Parking Garage	129	4.3%	526	N/A	N/A	7,921
Fire Station 2	108	3.6%	935	52,824	0.0177	13,859
Fogerty Park Pavilion[xxiii]	1	0.0%	6	-	-	199
Heman Park Pavilion[xxiii]	0	0.0%	2	-	-	136
Library	540	17.8%	3,063	43,000	0.0712	48,101
Millar Park Pavilion	2	0.0%	9	-	-	255
Parks Maintenance Shop	68	2.2%	738	6,100	0.1210	8,092

PW Sign Shop	34	1.1%	466	1,926	0.2420	5,470
Ruth Park Golf Maintenance Shop	21	1.0%	246	2,400	0.1025	3,241
Ruth Park Golf Pro-shop	68	2.2%	398	1,578	0.2522	7,027
Ruth Park Pump House	12	0.0%	48	N/A	N/A	1,150
Swimming Pool/ Rec. Center	523	17.3%	3,356	9,047	0.3710	47,762
The Green Center	23	1.0%	243	3,404	0.0714	3,642
TOTAL	3,030	100.0%	20,719	-	-	299,715

Table 24: *Summary of Buildings & Facilities Totals, 2005*

	CO_2 (metric tons)	**N_2O (kg)**	**CH_4 (kg)**	**CO_2e (metric tons)**	**CO_2e (%)**	**(MMBtu)**	**Cost ($)**
Subtotal Buildings & Facilities	3,016	42	82	3,031	40.5	20,738	300,174

Streetlights & Traffic Signals Sector Detailed Report

The "Streetlights & Traffic Signals" sector includes all traffic signals, all sidewalk lighting and all outdoor park-lighting owned and operated by the city. This category was responsible for *approximately 30.7% of University City's 2005 Government Operations emissions* making it the second highest emitting sector behind "Buildings & Facilities". Furthermore, the City spent *approximately $562,669* to power its streetlights and traffic signals in 2005, more than any other sector. A more in depth breakdown of this sector is provided in Table 25. As visible in this table, "unmetered street lighting" proved to be the largest GHG emitter, energy user, and the most expensive type of lighting to power.

The University City Department of Public Works is currently performing a comprehensive street lighting study aimed to save energy through the development of a more efficient street light policy. The 4,060 street lights inventoried within University City limits fall into the following three categories: privately-owned/Ameren operated; University City owned and operated; and Ameren-owned/operated but billed to University City. Within this report, only the approximate 460 street lights owned and operated by University City along with the approximate 3,339 street lights owned and operated by Ameren, but billed to University City have been included.[xxiv] University City-owned lights only account for one percent of the total lighting energy use. The Ameren-owned lights account *99 percent* of the lighting energy use and costs. According to the City's lighting study, there are eight different types of light fixtures comprising two main groups: Cobra and Post Top. The majority of these lights are furnished with one of three different bulb types: High Pressure Sodium (HPS), Mercury Vapor (MV), or Metal Halide (MH).[xxv]

Table 25: *Streetlights & Traffic Signals GHG Emissions, 2005*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	(MMBtu)	Cost ($)[xxvi]
Athletic Field Lighting[xxvii]	53	1	1	53	0.7	216	3,528
Decorative Park Lighting-Electricity[xxviii]	10	0	0	10	0.1	41	440
Metered Street Lighting[xxix]	83	1	1	84	1.1	342	5,945
Park Fountains-Electricity[xxx]	49	1	1	50	0.7	203	3,553
Park Sign Lighting-Electricity[xxxi]	6	0	0	6	0.1	26	549
Unmetered Street Lighting[xxxii]	2,017	34	23	2,028	27.1	8,292	531,469
Unmetered Park Lighting-Electricity[xxxiii]	65	1	1	65	0.9	267	17,185
Subtotal Streetlights & Traffic Signals	2,284	38	26	2,296	30.7	9,387	562,669

Other Process Fugitive (Solid Waste Facilities) Sector Detailed Report

As in the community analysis, these emissions are an estimate of lifecycle methane generation over the full, multi-year decomposition period of the waste generated in the year 2005. University City's solid waste treatment facility generated an estimated *0.5% of the city's 2005 total municipal emissions*. A more detailed report of the Solid Waste Facilities emissions is located in Table 26. Since the City does not have its own landfill, emissions from this sector come from the electricity used to operate the City's transfer station facility as well as the propane used by the forklifts to aid in the transfer of waste.

Table 26: *2005 Solid Waste Facilities GHG Emissions Data*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)	Cost ($)
Subtotal Solid Waste Facilities	40	1	0	40	0.5	165	3,107

Employee Commute Sector Detailed Report

In 2005, the Employee Commute sector accounted for *approximately 15% of the total emissions* from University City government operations (or *1,124 metric tons of* CO_2e). Emissions from this portion of the inventory result from the consumption of fuels by City employees in their commutes to and from work. It is important to note that GHG emissions from the employee commute sector are categorized as Scope 3 emissions because they are not emissions that the City has direct control over (e.g. City-owned buildings and facilities). Nonetheless, employee commute emissions are significant and local governments have the ability to develop programs to effectively improve commute patterns of their employees and thus reduce emissions.

In order to conduct the employee commute emissions analysis for this report, the City issued a survey to all of its employees[xxxiv]. In 2005, there were 310 full-time City employees, 121 of which effectively filled out the employee commute survey. The average daily commute for all survey respondents was *approximately 19.96 miles*.

Altogether, city employees commuted an estimated total of *1,569,735 miles* throughout the 2005 calendar year. Based on the Energy Information Administration's (EIA's) average gasoline price of $1.92 per gallon[xxxv] in 2005 and the average price of diesel fuel, $1.94 per gallon[xxxv], the estimated total cost of the City's employee commute is *$275,054*.

Table 27: *Employee Commute GHG Emissions, 2005*

	CO_2 (metric tons)	N_2O (kg)	CH_4 (kg)	CO_2e (metric tons)	CO_2e (%)	Energy (MMBtu)	Cost ($)
Employee in Survey with Hybrid	0	0	0	0	0.0	6	115
Employees in Survey	402	19	15	409	5.5	5,648	100,049

Estimated Commute for Full-time Employees	616	41	36	630	8.4	8,675	154,020
Estimated Commute for Hybrid	2	0	0	2	0.0	23	410
Estimated Commute for Part-time Employees	82	6	5	84	1.1	1,152	20,460
Subtotal Employee Commute	1,103	66	55	1,124	15.0	15,506	275,054

Vehicle Fleet Sector Detailed Report

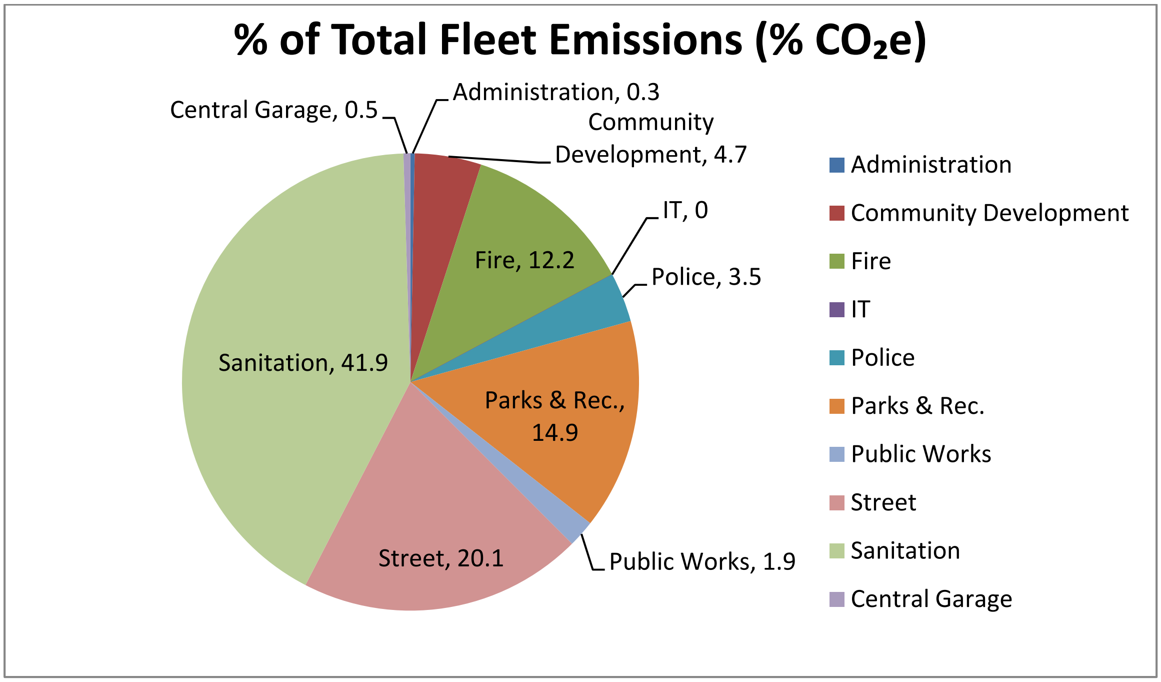
In 2005, the City-owned vehicle fleet was comprised of approximately 138 vehicles. For a complete listing of University City's 2005 vehicle fleet see APPENDIX H. As previously seen, the fleet of City-owned vehicles was the fourth largest source of municipal emissions in 2005. Additionally, the vehicle fleet sector represented the second most expensive sector in terms of energy costs in 2005. The fuel cost for the vehicle fleet sector was found using the annual average price of gasoline and diesel for 2005 provided by the Energy Information Administration. As previously mentioned in the Employee Commute section, the Energy Information Administration's (EIA's) determined the average gasoline price to be $1.92 per gallon[xxxv] in 2005 and the average price of diesel fuel to be $1.94 per gallon.[xxxv] *Approximately 57%* of the city fuel consumption was gasoline and the remainder was diesel. Ten departments of the City's municipal operations rely on various automobiles to provide the citizens of University City with exceptional services each and every day.

University City has made strides to improve the sustainability of its vehicle fleet by filling tires with nitrogen. Nitrogen-filled tires maintain pressure longer and run cooler than air-filled tires. The City expects this "green" practice to improve tire life and fuel economy which will translate into reduced tire maintenance/replacement, reduced long-term fuel costs and decreased greenhouse gas emissions for the City. Apart from the transformation to nitrogen-filled tires, the City now uses biodiesel 11 fuels in diesel-fueled city trucks. Biodiesel is simple to use, biodegradable, nontoxic, and essentially free of sulfur and aromatics. Additionally, biodiesel exhaust has a less harmful impact on human health than petroleum diesel fuel. Overall, biodiesel has demonstrated significant environmental benefits with a minimum increase in cost for the City's fleet maintenance program.

Table 28: *City-owned Vehicle Fleet Emissions by City Department, 2005*

City Department	CO_2e (metric tons)	% of Total Fleet Emissions	Gasoline Consumption (gal)	Diesel Consumption (gal)	Total Fuel Cost ($)	Energy (MMBtu)
Administration	3	0.3	248	0	497.20	85
Community Development	45	4.7	2,865	128	5,740.50	970
Fire	116	12.2	3,338	10,738	27,539.08	1,929
IT	0	0	33	0	63.36	4
Police	33	3.5	236,866.40	0	228,658.00	7,746
Parks & Rec.	142	14.9	10,821	6,678	33,828.27	1,950
Public Works	18	1.9	30,904	0	14,988	243
Street	192	20.1	7,003	16,181	45,717.57	2,631
Sanitation	399	41.9	3,648	38,359	80,943.31	5,437
Central Garage	5	0.5	998	248	2,353.02	60
TOTAL	953	100.0	296,724.4	72,332	440,328.31	21,055

Figure 14: *2005 City Fleet Vehicle GHG Emissions by Department*



Government Operations Emissions Forecast

While the community emissions growth forecast is based upon per capita energy consumption, workforce expansion, and population growth projections, the forecast of growth within municipal operations is based upon the expansion of City services or infrastructure. While there are no current plans to vastly expand City infrastructure, *it is assumed that there will be no major increase or decrease in annual emissions from municipal operations*.

Conclusion

In passing a resolution to endorse the U.S. Mayor's Climate Protection Agreement, the City of University City initiated a formal commitment to reduce greenhouse gas emissions. This inventory serves as an important step in reducing future emissions and ultimately in creating a more sustainable community.

This analysis found that the University City community as a whole was responsible for emitting *approximately 514,362 metric tons of* CO_2e *in the base year 2005.* The Residential Sector contributed the most to this total, producing approximately 44.8 percent of the total community emissions. The City of University City's own municipal operations were responsible for emitting *approximately 7,484 metric tons of* CO_2e *in the base year 2005*, with the greatest percentage of emissions coming from the City Buildings and Facilities, City Streetlights, and Employee Commute subsectors, respectively.

The author of this report recommends that the City continue to follow the climate mitigation procedures outlined by ICLEI in order to maintain their commitment to reduce GHG emissions. The results detailed in this report will allow the City to analyze large emitting sectors and better facilitate the emissions reduction targets and strategies outlined in the City's climate action plan.

The community of University City has acknowledged the impact of humans on the environment and strives to "lead by example", demonstrating that local governments can realize increased energy savings, environmental health and economic benefits by implementing "green" best practices.

When developing reduction strategies, all of the potential benefits should be considered: improved air quality, increased productivity, improved safety, strengthened community interaction, lower public service cost, better health, decreased fuel consumption, lower utility costs, a stronger local economy, decreased greenhouse gas emissions and many more. The incorporation of emissions reduction strategies can allow the citizens of University City to work towards a healthier, more livable community that they can all take pride in.

Appendices

APPENDIX A: Glossary of Terms: [v, iv]

Biodiesel - Biodiesel is the name of a clean burning alternative fuel produced from domestic, renewable resources. It contains no petroleum, but can be blended at any level with petroleum diesel to create a biodiesel blend.

Calendar Year - The time period from January 1 through December 31.

Carbon Dioxide (CO_2) - The most common of the six primary GHGs, consisting of a single carbon atom and two oxygen atoms, and providing the reference point for the GWP of other gases. (Thus, the GWP of CO_2 is equal to 1).

Ccf - An American standard unit of measurement that stands for 100 cubic feet. This unit is commonly used in the billing of natural gas and water for residences. One "Ccf" is equivalent to 748 gallons of a liquid.

CO_2 equivalent (CO_2e) - The universal unit for comparing emissions of different GHGs expressed in terms of the GWP of one unit of carbon dioxide. Essentially the effects of other greenhouse gases are converted into the equivalent amount of metric tons of carbon dioxide.

Direct Emissions - Emissions from sources within the reporting entity's organizational boundaries that are owned or controlled by the reporting entity, including stationary combustion emissions, mobile combustion emissions, process emissions, and fugitive emissions. All direct emissions are Scope 1 emissions, with the exception of biogenic CO_2 emissions from biomass combustion.

Double Counting - Two or more reporting entities taking ownership of the same emissions or reductions.

Emission Factor - A unique value for determining an amount of a GHG emitted on a per unit activity basis (for example, metric tons of CO_2 emitted per million Btu's of coal combusted, or metric tons of CO_2 emitted per kWh of electricity consumed).

Entity - Any business, corporation, institution, organization, government agency, etc., recognized under U.S. law and comprised of all the facilities and emission sources delimited by the organizational boundary developed by the entity, taken in their entirety.

Facility - Any property, plant, building, structure, stationary source, stationary equipment or grouping of stationary equipment or stationary sources located on one or more contiguous or adjacent properties, in actual physical contact or separated solely by a public roadway or other public right-of-way, and under common operational or financial control, that emits or may emit any greenhouse gas.

Fossil Fuel - A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.

Fugitive Emissions - Emissions that are not physically controlled but result from the intentional or unintentional release of GHGs. They commonly arise from the production, processing, transmission, storage and use of fuels or other substances, often through joints, seals, packing, gaskets, etc. Examples include CH_4 from solid waste landfills.

Global Warming Potential (GWP) - The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one mass-based unit of a given GHG compared to one equivalent unit of carbon dioxide (CO_2) over a given period of time.

Global Warming - The increase in the near surface air and ocean average temperature that has occurred since the mid 20^{th} century. The Intergovernmental Panel on Climate Change (IPCC) has concluded that an increase in greenhouse gas concentration resulting from human activities, such as burning fossil fuels, have caused most of the increase in average temperature that have occurred.

Greenhouse Gases (GHGs) - Any of several gases, including (but not limited to) carbon dioxide (CO_2), water vapor, methane (CH_4), ozone (O_3), and nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), that when released into the atmosphere, absorb and emit radiation (heat).

Indirect Emissions - Emissions that are a consequence of activities that take place within the organizational boundaries of the reporting entity, but that occur at sources owned or controlled by another entity. For example, emissions of electricity used by a manufacturing entity that occur at a power plant represent the manufacturer's indirect emissions.

Inventory - A comprehensive, quantified list of an organization's GHG emissions and sources.

Kilowatt Hour (kWh) - The electrical energy unit of measure equal to one thousand watts of power supplied to, or taken from, an electric circuit steadily for one hour.

Methane (CH_4) - A GHG, consisting of a single carbon atom and four hydrogen atoms, possessing a GWP of 21, and produced through the anaerobic decomposition of waste in landfills, animal digestion, decomposition of animal waste, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Metric Ton (tonne) - A common international measurement for the quantity of GHG emissions, equivalent to 1,000 kg and approximately 2,205 lbs. This unit is also referred to as a tonne or metric tonne.

MMBtu - BTU stands for British Thermal Unit. MMBtu represents one million BTU. These units are used to describe the heat value or energy content of a fuel. More specifically, a BTU is defined as the amount of heat required to raise the temperature of one pound of liquid water by one degree Fahrenheit at a constant pressure of one atmosphere.

Mobile Combustion - Emissions from the combustion of fuels in transportation sources (e.g. cars, trucks, buses, trains, airplanes, and marine vessels) and emissions from non-road equipment cannot move under its own power but that is transported from site to site (e.g., an emergency generator) is a stationary, not a mobile, combustion source.

Natural Gas - A naturally occurring mixture of hydrocarbons (e.g. methane) produced in geological formations beneath the earth's surface that maintains a gaseous state at standard atmospheric temperature and pressure under ordinary conditions.

Nitrous Oxide (N_2O) - A GHG, consisting of two nitrogen atoms and a single oxygen atom, possessing a GWP of 310, and typically generated as a result of soil cultivation practices, particularly the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.

Operational Boundaries - The boundaries that determine the direct and indirect emissions associated with operations within the entity's organizational boundaries.

Process Emissions - Emissions from physical or chemical processing rather than from fuel combustion. Examples include emissions from manufacturing cement, aluminum, adipic acid, ammonia, etc.

Scope - Defines the operational boundaries in relation to indirect and direct GHG emissions.

Stationary Combustion - Emissions from the combustion of fuels to produce electricity, steam, heat, or power using equipment (boilers, furnaces, etc.) in a fixed location.

Sustainability - The ability to meet present needs without compromising the ability of future generations to meet their needs. A "sustainable" community is one which will fulfill present and future needs without depleting resources and harming natural systems.

Therm - A unit of heat energy typically used by natural gas companies to convert the volume of a gas into its actual energy use. One therm is equivalent to 100,000 BTU and is approximately equal to burning one hundred cubic feet (1 Ccf) of natural gas.

VMT - Vehicle Miles Traveled. The total amount of miles driven by vehicles within a certain geographical area and time.

APPENDIX B: Final Resolution for Community Sustainability:

RESOLUTION

Resolution of the City of University City for Community Sustainability

WHEREAS, there is abundant scientific evidence that the manner in which human society is currently living is unsustainable: we are jeopardizing the lives of future generations because we are significantly changing our climate; we are exacerbating many human and environmental health problems; we are rapidly depleting our non-renewable resources; and we are driving species to extinction; and

WHEREAS, these challenges are global in nature, but our success in finding their solutions will start with and rely on collective, collaborative local efforts; and

WHEREAS, the City of University City recognized this key challenge when it became a signatory to the U.S. Conference of Mayors Climate Action Agreement and committed to significant greenhouse gas emissions reductions by 2012; and

WHEREAS, since the City of University City signed the Action Agreement there is evidence that global climate change is accelerating; and

WHEREAS, the Green Practices Committee of the City of University City was formed to develop a comprehensive strategic plan that will guide the city to become sustainable at the municipal, residential, institutional and commercial levels; and

WHEREAS, it is the mission of the Green Practices Committee to encourage sustainable practices and programs that improve the health and quality of life of our community; protect and restore its natural resources, and strengthen our economy; and

WHEREAS, it is the Green Practices Committee's vision to have a fully engaged community that integrates sustainability into every decision made, and every action taken by city government, citizens, employees, business owners, students, and patrons; and

WHEREAS, University City aspires to be the leader in community sustainability;

NOW THEREFORE, be it resolved that the City Council of University City, by this Resolution, hereby reaffirms our commitment to the community and the world that sustainability is a primary factor that will inform our decisions, actions, activities, purchases and community outreach; and

BE IT FURTHER RESOLVED that the City shall adopt a Community Sustainability Plan as soon as practicable; and

BE IT FURTHER RESOLVED that in order to develop that Community Sustainability Plan City Council acknowledges that there are necessary first steps and therefore commits to the community that within one year the City shall:

1. perform a Greenhouse Gas (GHG) Emissions Inventory (which includes the municipality, residences, institutions and businesses) with the assistance of ICLEI and set aggressive but attainable emission reduction goals for 2015, 2020 and 2025 that align with the U.S. Conference of Mayors Climate Protection Agreement; and
2. perform energy audits of all City facilities and develop an Energy Master Plan to reduce the amount of energy used in its operations;

3. define sustainable design guidelines for capital projects and the respective return on investment expectations for such projects; and

4. analyze its street lighting and develop a comprehensive approach to reduce energy use and cost; and

and within 18 months the City shall:

5. revise its Building and Zoning codes to align with sustainable design, construction and operating best practices; and

BE IT FURTHER RESOLVED that the City shall conduct community and City staff outreach and education about Green and Sustainable practices.

Adopted this 21st day of September, 2009

Joseph Adams
Mayor

Attest:

Joyce Pumm
City Clerk

APPENDIX C: Resolution Addendum:

Addendum to
Resolution of the City of University City for Community Sustainability

Date: September 21, 2009

To: City Council

From: Petree A. Eastman

Re: Background for Sustainability Resolution

Introduction

This addendum is intended to provide background information in support of the "Resolution of the City of University City for Community Sustainability" recommended for adoption by the Green Practices Committee. **It is Committee's goal for the Resolution to set a new course on the means and methods by which the City conducts its business and to serve as an example to the community.** It is important to note that the actions called for in the resolution are primarily pre-plan evaluative measures necessary to the recommendations the Committee will ultimately make in developing the sustainability plan. They are first steps; these do not constitute the plan itself

In order to make the best decisions to reduce the community and the City's ecological footprint (carbon, methane, water, and natural resource use), some preliminary evaluative measures must be taken. It is a typical planning approach (evaluate, plan, implement, evaluate). Thus it is standard protocol to assess the existing carbon footprint of the city in order make specific sustainability decisions and then measure the impact of actions taken. There are two primary measurements that must be assessed: the greenhouse gas (GHG) inventory and energy audits of city facilities. The first will look at the City's greenhouse gas emissions, as well as the community's. A subset of the first is to have energy audits conducted at each of the City's facilities. Through knowledge of the sources of our emissions and energy usage, better and more informed decisions about capital improvements, behavior changes and policy can be made. Based on data about where we are currently, the ultimate goal of the Green Practices Committee is to devise a sustainability plan that leads our community to have zero impact on the earth.

The additional measures discussed in the proposed resolution are known subject areas that will have to be addressed regardless of the baseline data. Street lighting is by far the highest energy cost to the City and may be the area single greatest savings that can be made. Likewise, buildings of all types are a primary source of carbon emissions and so an update of our zoning and building code to a "green" code is in order.

The Green Practices Committee is seeking endorsement of these measures through the proposed Resolution. Below is more information about each of these measures and estimated cost to execute.

Greenhouse Gas Inventory

The warmth of the earth is a natural phenomenon of our planet. However, from human activity during the 20th and 21st centuries there is scientific evidence that the earth is warming at an alarmingly accelerated pace that threatens our very existence. Global warming is caused by large amounts of greenhouse gases made up of carbon dioxide and methane being trapped in the earth's atmosphere. Emissions from carbon dioxide are produced whenever fossil fuels are burned (oil, natural gas, gasoline, diesel fuel and coal). As result of even a slight increase of global temperature, major changes in climate patterns have been emerging, including extreme weather events (such as Hurricane Ike and other major flood inducing storm activity). Methane (or CH_4) is a byproduct of organic waste and sewage decomposition. Organic waste is made up of paper, yard trimmings, wood and food waste as it decomposes in landfills. Sewer treatment plants are a significant source of methane, which is 21 times more powerful per unit than CO_2 in its greenhouse effect.

While it may seem like the actions of one community cannot change the global climate, it is the Green Practices Committee's belief that if each community measures its greenhouse gas emissions and takes immediate action to curtail activities that cause increased emissions, that we will indeed affect climate change for the better. University City aspires to be the leader in community sustainability and as such should set the protocol in the actions it takes to reduce the community's carbon footprint. The first step is to measure exactly where we are through a greenhouse gas inventory. The baseline of data will inform policy, decisions and actions taken by the City and the community. As an example, Creve Coeur performed their greenhouse gas inventory and found, to their surprise, that much of the traffic related emissions are not from its three major thoroughfares (I-270, Lindbergh and Olive), but from the 99 miles of collector streets. Without this information, the City of Creve Coeur may have approached their plan for the reduction of greenhouse gas emissions in a completely different manner.

It is important to note that CO_{2e}, which is being measured, is the result of *energy consumed, fuel used and land-fill and other waste generated*. It is also important to note that GHG emissions are not necessarily emitted in our community. The GHG inventory measures in part the emissions from *where the electricity is generated.* Electricity itself does not produce carbon emissions, but rather *the process* of generating electricity is where GHG are emitted. Here, Ameren's coal-fired electricity generation plants, which is its primary method of generating electricity, is the primary cause of carbon emissions. To insure the accuracy of the GHG inventory, the measurement of GHG uses coefficients that are based on electric generation of the fuel mix on the grid for our region. Reduction in electricity usage does reduce electricity generation and therefore emissions. So reduction in electricity usage is key.

APPENDIX D: The U.S. Mayor's Climate Protection Agreement:

The U.S. Mayors Climate Protection Agreement
(As endorsed by the 73rd Annual U.S. Conference of Mayors meeting, Chicago, 2005)

A. We urge the federal government and state governments to enact policies and programs to meet or beat the target of reducing global warming pollution levels to 7 percent below 1990 levels by 2012, including efforts to: reduce the United States' dependence on fossil fuels and accelerate the development of clean, economical energy resources and fuel-efficient technologies such as conservation, methane recovery for energy generation, waste to energy, wind and solar energy, fuel cells, efficient motor vehicles, and biofuels;
B. We urge the U.S. Congress to pass bipartisan greenhouse gas reduction legislation that 1) includes clear timetables and emissions limits and 2) a flexible, market-based system of tradable allowances among emitting industries; and
C. We will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities such as:

1. Inventory global warming emissions in City operations and in the community, set reduction targets and create an action plan.
2. Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
3. Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit;
4. Increase the use of clean, alternative energy by, for example, investing in "green tags", advocating for the development of renewable energy resources, recovering landfill methane for energy production, and supporting the use of waste to energy technology;
5. Make energy efficiency a priority through building code improvements, retrofitting city facilities with energy efficient lighting and urging employees to conserve energy and save money;
6. Purchase only Energy Star equipment and appliances for City use;
7. Practice and promote sustainable building practices using the U.S. Green Building Council's LEED program or a similar system;
8. Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel;
9. Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production;
10. Increase recycling rates in City operations and in the community;
11. Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO2; and
12. Help educate the public, schools, other jurisdictions, professional associations, business and industry about reducing global warming pollution.

APPENDIX E: 2005 Community Emissions Inventory Notes:

Residential, Commercial, and Industrial

Notes:

- University City's 2005 community "R, C, I" values were comprised of both electrical and natural gas consumption figures. The electricity data was provided by Shirley Stennis, Senior Supervisor, Municipal and Public Accounts, AmerenUE. Determining the annual electricity consumption for each of these three community sectors was the first major step. The next step was to select appropriate emissions factors. An electricity emission factor represents the amount of GHGs emitted per unit of electricity consumed. It is typically reported in units of pounds of GHG per kWh. The author of this report utilized the EPA's 2007 eGRID regional default emission factors for the Subregion SRMW (SERC Midwest).[2] It should be noted that despite the electricity consumption data and emissions resulting from streetlights and traffic signals, which traditionally represents a separate category, was proportionally averaged by usage sector (residential, commercial, and industrial) and then added to respective sectors total.

- The remaining portion of the community's "R, C, I" sector emissions is comprised of natural gas figures. Natural gas usage figures were provided by Robert Arrol of Laclede Natural Gas Company in the form of a spreadsheet containing natural gas consumption in therms for 2005. The annual totals from each sector were entered into the CACP software program to obtain corresponding emissions values.

Data Sources:

- Shirley Stennis**,** Senior Supervisor, Municipal and Public Accounts, AmerenUE. Phone: (314) 554-2048. Email: sstennis@ameren.com

- Robert Arrol, Manager, Corporate Communications, Laclede Natural Gas Co. Phone: (314) 342-0654. Email: RArrol@lacledegas.com

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

Transportation

Notes:

- Provided traffic count records on arterial and local roads from every location St. Louis County count within University City. Forest Park Parkway counts are from 2002, Big Bend, North & South, Midland, Vernon, Kingsland, Woodson, Mc knight, and Pennsylvania, counts are from 2003, Hanley, Olive, and Delmar counts are from 2004.
- Road length for the different types of roads within University City was collected . Also confirmed the Delmar Blvd.'s non-arterial road length.

Data Sources:

- Phil Buchanan, Engineering Technician III, St. Louis County Department of Highways and Traffic.

Phone: (314) 615-1141. Email: PBuchanan@stlouisco.com

- Angelica Gutierrez, Project Manager, Public Works Department, University City.
  Phone: (314) 505-8568. Email: agutierrez@ucitymo.org

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

Waste

Notes:
- Provided 2003 land filled waste tonnage and confirmed the validity of ICLEI's default waste type percentages at the University City.

Data Sources:

- Lynnette Hicks, Senior Public Works Manager, University City Public Works Department.
  Phone: (314) 505-8567. Email: lhicks@ucitymo.org

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

"Other" Emissions Sectors: Waste Water Facilities

Notes:
- According to Mr. Litzsinger, "MSD has calculated its carbon footprint as 174,854 metric tons, excluding biogenic carbon emissions. Therefore, this can be translated into a per capita or volume of wastewater treated unit: 0.0010 metric tons [of] GHG emissions per CCF [of] wastewater treated, or 0.1281 metric tons/capita." This is the same data that was provided to Olivette and St. Louis County and used in their GHG emission inventories. Multiplying this per capita value by University City's 2005 population of 32,885 resulted in the emissions of approximately 4,213 metric tons of CO_2e.

Data Sources:

- Bruce Litzsinger, Metropolitan Sewer District (MSD).
  Phone: (314). Email:

"Other" Emissions Sectors: Water Delivery Facilities

Notes:

- Provided the Central Plant's 2003 electrical use and the number of population served by the Central Plant. Based on U-City's 2003 population, the energy usage on water was estimated.
- "Every 1,000 gallons of water pumped to Kirkwood requires 2.05 kWh of electricity."

Data Sources:

- Bob Fuerman, Production Director, Missouri American Water.
  Phone: (314) 996-2462. Email: Bob.Fuerman@amwater.com

Brita Pagels, Program Officer for ICLEI's Midwest Regional Office advised the authors of this report to use waste stream percentages provided by the U.S. EPA's document on municipal solid waste generation, recycling, and disposal in the United States. Included in these values is a percentage for "yard trimmings", which was used despite the fact that all yard waste in the city is composted and not sent to the landfill. The authors of this report were also advised to use these figures "as is" without making any changes despite any differences in the local waste stream. As a result, the emissions for the waste sector are slightly higher than they should be because the software assumes that the yard waste is transported to a landfill. A side note was written to ensure that readers realize that this reduction in emissions was not entered into the software program in order to avoid changing the waste stream percentages presented by the U.S. EPA.

APPENDIX F: 2005 Government Operations Emissions Inventory Notes:

Municipal Buildings & Facilities

Notes:

- University City's 2005 municipal operations buildings and facilities energy use figures were extracted from city electrical and natural gas bills for each facility, respectively.
- The energy costs reported for this subsector include a tax rate of 9%.

Data Sources:

- Dennis Apel, Accounts Payable, University City.
  Phone: (314) 505-8643. Email: dapel@ucitymo.org

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

Municipal Streetlights & Traffic Signals

Notes:

- Electricity use and cost for city-owned streetlights and traffic signals was compiled using Ameren bills.
- Background information on the makeup of street lights in University City was abstracted from "University City, MO Street Lighting Study", authored by Jenny Wendt.

Data Sources:

- Dennis Apel, Accounts Payable, University City.
  Phone: (314) 505-8643. Email: dapel@ucitymo.org
- Jenny Wendt, GEO Data Collector/Street Lighting Assistant, University City.
  Phone: (314) 505-8562 Email: jwendt@ucitymo.org

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

Other Process Fugitive

Municipal Solid Waste Facilities

Notes:

- Emissions from this sector came from the electricity used to operate the City's transfer station facility as well as the propane used by the forklifts to aid in the transfer of waste.
- Electricity use and cost from University City's transfer station was extracted from Ameren bills.
- Propane use for forklifts within the transfer station resulting in an insignificant amount of greenhouse gas emissions and was therefore not included within this report.
- It is important to note that all bills from Laclede Gas for the City's buildings and facilities were from the fiscal year 2008-2009 which began in April 2008 and ended in March

2009. The same procedure that was used to total the electrical and water consumption values was used for the natural gas figures.

Data Sources:

- Dennis Apel, Accounts Payable, University City.
  Phone: (314) 505-8643. Email: dapel@ucitymo.org

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

Municipal Vehicle Fleet

Notes:

- The software uses a set of vehicle defaults which includes heavy duty vehicles (e.g. sanitation trucks, etc.), light trucks, and passenger cars. After determining the appropriate type of vehicle, the program allows you to select a default year (e.g. Heavy Duty Vehicles MY 2001 or Passenger Cars MY 2005) and then provides a subsequent emissions coefficient that is used along with the total number of gallons of fuel used by that type of vehicle for a given city department.
- Fuel Cost (EIA averages for 2005): Gasoline: $1.92, Diesel: $1.94.

Data Sources:

- Received Type 2 (Off Road) Vehicle 2005 & 2009 data from Ewald Winker, Parks Recreation and Forestry. Propane use from Tom McCarthy, Parks Recreation and Forestry.
- Received 2005 propane usage data from Chris Horne, Streets Department. Chris also provided information for number of vacant lots mowed by the city in 2009. Still 2009 propane data and 2005 lawn maintenance records for vacant lots.
- Received Type 2 Vehicle data from Don Humphrey, Golf Course.
- Tom Brushwood, Fleet Maintenance Manager, University City.
  Phone: (314) 505-8559. Email: tbrushwood@ucitymo.org
- Ewald Winker, Parks Maintenance Superintendant, University City.
  Phone: (314) 505-8618. Email: ewinker@ucitymo.org
- Chris Horne, Account Clerk, University City.
  Phone: (314) 505-8770. Email: chorne@ucitymo.org
- Don Humphrey, Golf Maintenance Supervisor, University City.
  Phone: (314) 505-8621. Email: dhumphrey@ucitymo.org

Municipal Employee Commute

Notes:

“Employees in Survey”

- Data for the Employee Commute Survey was provided by Petree Eastman. The survey was predominately conducted online; however, hard copies were provided for employees without computer access. In 2005, there were a total of 121 usable survey responses. Emissions values were calculated by entering the total VMT calculated. The VMT values were calculated using the average daily commute, approximately 19.96 miles per day, and the estimated number of days worked annually based on a 48 week work calendar. Type of vehicle and model year based on reported. The energy cost was calculated using the corresponding number of gallons of fuel used and the average annual costs of fuel for 2005.

“Employee in Survey with Hybrid Vehicle”

- Due to its increased fuel efficiency, required a different procedure than the vehicles found in the “Employees in Survey” category. Utilization of the software’s average fuel efficiency for a 2005 hybrid vehicle (passenger car) would result in an inflated emissions estimate. Hybrid gasoline usage was determined outside of the CACP software program by using a Toyota Prius as the sample 2005 hybrid vehicle. The vehicle’s fuel efficiency is 46 miles per gallon.

“Employees Not-in-Survey”

- The total number of 2005 “Full-time Employees Not-In-Survey” was determined by taking the difference between the total number of 2005 employees as summarized by the Annual Administrative Report for the Fiscal Year 2004-2005, and 2005-2006 minus the number of completed surveys. Average daily and annual commute based on survey data was used to estimate the VMT for employees not in the survey. The proportion of vehicle type and fuel type were based on the survey data. Since there is no way to estimate model year, all vehicles with the exception of hybrid vehicles, were entered using CACP Alt. Method. The cost of fuel was estimated using gallons of fuel, using CACP built-in conversion, and 2005 average annual cost. Data on the “Part-time Employees Not-In-Survey” was calculated using the same process as the one above for the full-time employees.

Data Sources:

- Petree Eastman, Former Assistant to the City Manager, City of University City.

Data entered by Jeanne Baker, former Environmental Assistant, City of University City.

APPENDIX G: Employee Commute Survey:

1. Employee Commute in 2009

This information is being gathered as part of University City's greenhouse gas emissions inventory. We are attempting to quantify the City's carbon footprint. The goal is to reduce energy consumption, save money, reduce green house gas emissions, and reduce local air pollution. All information will be kept anonymous and confidential.

Thank You!

For the year 2009, please make your best estimate for the following questions:

1. On average, how many days per week did you work in 2009?

- ☐ Full-time (non-uniformed 40 hours)
- ☐ Full-time (police)
- ☐ Full-time (fire)
- ☐ Part-time (less than 32 hours)

*** 2. On an average day, how many miles did you travel to work round trip each work day in 2009? (enter number only, e.g if you drove 17 miles roundtrip each day, enter the number 17, not "17 miles")**

3. Please indicate the origin of your comute to work during 2009:

- ○ University City
- ○ St. Louis County but not within University City
- ○ Missouri but not within St. Louis County
- ○ Illinois

4. If you lived in more than one location in 2009 where did you live and for how many months in each location? (enter numbers only, e.g. if you lived in one location 3 months, simply enter the number 3 in the appropriate box, not "3 months")

University City

St. Louis County but not within University City

Missouri but not within St. Louis County

Illinois

Not Applicable

5. Please indicate the number of days that you used a particular mode of transportation throughout an average 5-day week of commuting to work in 2009: (enter numbers only, e.g. if you drove alone 5 days a week, enter the number 5 in the appropriate box, not "5 days")

Drove Alone

Drove in a Carpool

Rode in a Carpool

Took public transit (Bi-state, Metrolink)

Bike

Walked

6. If you drove or rode in a carpool, how many other persons (U City employees or employees of other employers)traveled with you on average?

- 1
- 2
- 3
- 4 or more
- Not applicable

7. If you drove or rode (alone or in a carpool), what type of vehicle was most often used in 2009?

- Auto-full size
- Auto-mid size
- Auto-compact
- Hybrid
- Heavy Truck
- Light truck/SUV
- Motorcycle
- Motor Scooter
- Van

8. If you drove or rode (alone or carpool), what was model year of the vehicle that was driven most often during 2009? (enter a year only, e.g. 2004, not 2004 Ford)

9. If you drove or rode(alone or in a carpool), what type of fuel does the vehicle that was driven most often during 2009?

- Gasoline
- Diesel
- Ultra-low sulfur diesel
- Bio-diesel
- Ethanol
- Electric
- LPG
- Compressed natural gas

10. If you answered, "bio-diesel" in the last question, what percentage bio-diesel did you use? (enter a number only e.g. if you used B-20 this equals 20%, enter 20, not 20 percent or 20%)

2. Commute During 2005

If you were working for the City of University City during 2005, please make your best estimate for the following questions: (if not continue to question #21)

11. On average, how many days per week did you work in 2005?

- Full-time (non-uniformed 40 hours)
- Full-time (police)
- Full-time (fire)
- Part-time (less than 32 hours)

12. On an average day, how many miles did you travel to work round trip each work day in 2005? (enter a number only, e.g. if you drove 17 miles roundtrip each day, enter the number 17, not "17 miles")

13. Please indicate the origin of your comute to work during 2005:

- University City
- St. Louis County but not within University City
- Missouri but not within St. Louis County
- Illinois

14. If you lived in more than one location in 2005 where did you live and for how many months in each location? (enter numbers only, e.g. if you lived in one location 3 months, enter the number 3 in the appropriate box, not "3 months".

University City	
St. Louis County but not within University City	
Missouri but not within St. Louis County	
Illinois	
Not applicable	

15. Please indicate the number of days that you used a particular mode of transportation throughout an average 5-day week of commuting to work in 2005: (enter numbers only, e.g. if you drove alone 5 days per week, enter the number 5, not "5 days")

Drove Alone	
Drove in a Carpool	
Rode in a Carpool	
Took public transit (Bi-state, Metrolink)	
Bike	
Walked	

16. If you drove or rode in a carpool in 2005, how many other persons (U City employees or employees of other employers) traveled with you on average?

- 1
- 2
- 3
- 4 or more
- Not applicable

17. If you drove or rode (alone or in a carpool), what type of vehicle was most often used in 2005?

- Auto-full size
- Auto-mid size
- Auto-compact
- Hybrid
- Heavy Truck
- Light truck/SUV
- Motorcycle
- Motor Scooter
- Van

18. If you drove or rode (alone or carpool), what was model year of the vehicle that was driven most often during 2005? (enter a year only, e.g. 2004, not "2004 Ford")

19. If you drove or rode (alone or in a carpool), what type of fuel does the vehicle that was driven most often during 2005?

- Gasoline
- Diesel
- Ultra-low sulfur diesel
- Bio-diesel
- Ethanol
- Electric
- LPG
- Compressed natural gas

20. If you answered, "bio-diesel" in the last question, what percentage bio-diesel did you use? (e.g. if you used B-20 this equals 20%, enter 20, not 20 percent or 20%)

3. Green Practices in the Future

Whether or not you worked for University City in 2005, please answer the final the questions.

21. Based on where you live today, how difficult would it be for you to use an alternative mode of transportion (mass transit, carpool, walk, or bike) besides commuting alone?

- Very difficult (no transit available; no employees nearby to commute; too far to walk or bike)
- Difficult (transit available but signficant driving still required; walk too long; no safe bike lanes; hours worked difficult for carpooling)
- Not Difficult (transit nearby but requires short walk or drive; walking limited to good weather days; some good bike lanes; other employees work similar hours)
- Easy (transit very close and requires no driving; walking not a problem; bike lanes entire route; other employees live very close and have the same work hours)

22. If a daily incentive were available, would you be willing to use mass transportion? (e.g. Bus, Metrolink)

- Yes
- No
- Maybe
- Not applicable

23. Please rate the top three alternative transportation modes that you would most likely use (1 as the most likely, 3 as the third most likely):

Car pool

Van pool

Bus

Metrolink

Bike

Walk

Other

Thank you for your time!

APPENDIX H: 2005 City-owned Vehicle Fleet:

Vehicle Number	Description
1	2004 CHEVY IMPALA
2	2003 CHEVY IMPALA
3	2003 CHEVY IMPALA
4	2003 CHEVY IMPALA
5	2003 CHEVY IMPALA
6	2004 CHEVY IMPALA
7	2004 CHEVY IMPALA
8	2004 CHEVY IMPALA
9	2003 CHEVY IMPALA
10	2003 CHEVY IMPALA
11	2003 CHEVY IMPALA
12	2003 CHEVY IMPALA
13	2003 CHEVY IMPALA
14	2003 CHEVY IMPALA
15	2002 CHEVY IMPALA
16	MONTE CARLO 2001 Chevrolet EMG SEDAN, UNMARKED,
17	2002 CHEVY IMPALA
18	2002 JEEP LIBERTY
19	2003 CHEVY IMPALA
20	SILVER 2002 Chevrolet EMG SEDAN, UNMARKED, INVE
21	2005 Chevy Malibu
22	2002 CHEVY IMPALA SILVER 934-LGM JULY
23	2002 CHEVY IMPALA RED 593-FNS OCTOBER
24	2002 CHEVY IMPALA SANDRIFT 930-LGM JULY
25	2002 CHEVY IMPALA BLUE 563-DNH JULY
26	2002 CHEVY IMPALA GREEN 592-FNS OCTOBER
27	2002 CHEVY IMPALA SANDRIFT 562-DNH JULY
28	2003 CHEVY IMPALA
29	2002 CHEVY IMPALA
30	2000 CHEVY ASTRO VAN
31	2003 TRUCK, MD, DUMP 2-3 YD
32	2001 Freightliner FLD112 TRUCK, HD, TRACTOR, DO
33	1980 GMC Freightliner (Heavy Truck)
34	2002 Pak-Mor HLR24 TRUCK, HD, REFUSE SIDE LOAD,
35	2004 Bridgeport Ranger TRUCK, HD, REFUSE SIDE L
36	2003 Pak-Mor HLR24 TRUCK, HD, REFUSE SIDE LOAD,
37	2004 Chevrolet 2500 HD PICKUP, 3/4 T, UTILITY W
38	2000 Peterbilt 320-Heil 7000 (Heavy Truck)
39	2002 Pak-Mor HLR24 TRUCK, HD, REFUSE SIDE LOAD,
40	1995 Crane Carrier Centurion
41	2005 Bridgeport Ranger TRUCK, HD, REFUSE SIDE L
42	2000 Volvo WX64 - Bridgeport (Heavy Truck)
43	1997 Crane Carrier CENTURION LET40 - A - RRL 25
44	1996 Crane Carrier CENTURION LET40 - C -RRL 25-
45	1996 Freightliner FLD112 64ST TRUCK, HD, TRACTO
47	2000 Pak-Mor RHC225B TRUCK, HD, REFUSE REAR LOA

48	1996 American Hook 620 TRUCK, HD, REFUSE DUMPST
50	2003 GMC C5C042 dump bed TRUCK, MD, DUMP 2-3 YD
51	2003 GMC C5C042 dump bed TRUCK, MD, DUMP 2-3 YD
52	Manitex 956 crane TRUCK, HD, FLATBED W/CRA
53	2000 GMC C7H042 TRUCK, HD, AERIAL 50-60' INSL B
54	VERMEER 1250 BC CHIPPER 1996 Vermeer 1250 BC BRUSH
55	1996 Carlton 7200 STUMP CUTTER, TOWED
56	1979 Cushman Truckster dump bed CART, PARKING E
57	1994 Kawasaki 2500 CART, UTILITY, GAS
60	2002 Chevrolet Silverado 2500HD PICKUP, 3/4 T,
61	2001 CHEVY 2500HD 4X4 PICKUP
62	2002 Chevrolet Silverado 2500HD PICKUP, 3/4 T,
63	2005 Freightliner M2-106 TRUCK, HD, DUMP 5-7 YD
64	2001 CHEVY 2500HD 4X4 PICKUP
65	2005 Chevrolet Silverado 2500HD PICKUP, 3/4 T,
67	2005 Freightliner M2-106 TRUCK, HD, DUMP 5-7 YD
68	2001 CHEVY 2500HD 4X4 PICKUP
69	2003 New Way 6RL Diamondback TRUCK, MD, REFUSE
70	2005 Chevrolet Silverado LD 3500 TRUCK, 1 T, DU
71	1994 John Deere 5300 TRACTOR, UTILITY, MEDIUM
72	2001 Fermec 640B TRACTOR, UTILITY, MEDIUM, 4X4
73	1996 John Deere 5200 TRACTOR, UTILITY, HEAVY
74	1994 John Deere 5300 TRACTOR, UTILITY, MEDIUM
76	1996 John Deere 5200 TRACTOR, UTILITY, MEDIUM
78	2002 Chevrolet Silverado 2500 HD PICKUP, 3/4 T,
79	1999 CHEVY S10 PICKUP
80	2001 New Way 6RL Diamondback TRUCK, MD, REFUSE
81	1997 Pro Patch TCM 415-160 TRUCK, HD, W/PATCHER
82	1999 Chevrolet K3500 TRUCK, 1 T, UTILITY BODY,
83	2000 GMC C7500 TRUCK, HD, DUMP 5-7 YD W/PLOW &
84	2000 GMC C7500 TRUCK, HD, DUMP 5-7 YD W/PLOW &
85	2000 GMC C7500 TRUCK, HD, DUMP 5-7 YD W/PLOW &
86	E-Z-GO CART, GOLF, GAS
88	2001 Case 721C LOADER, WHEEL, 2 YD
89	1991 John Deere 544E Wheel Loader
90	AIR COMPRESSOR 2000 LeROI COMPRESSOR, AIR, 185+
91	1995 John Deere 7800 TRACTOR, W/LOADER
92	2005 Freightliner M2-106 TRUCK, HD, DUMP 5-7 YD
93	1991 Gilson CONCRETE MIXER, TRLR MTD
94	1998 Peterson TL3 KNUCKLEBOOM TRUCK, HD, FLATBE
95	2005 Freightliner M2-106 TRUCK, HD, DUMP 5-7 YD
98	2001 CHEVY 3500HD Bucket truck
99	2003 CHEVY IMPALA 898-BLJ MARCH
100	Pickup 2005 Chevrolet Silverado 2500HD PICKUP,
101	Dump 2005 Freightliner M2-106 TRUCK, HD, DUMP
102	dump 2005 Freightliner M2-106 TRUCK, HD, DUMP
103	Sweeper 2002 Elgin Pelican TRUCK, HD, STREET S
104	Sweeper 2003 Elgin Pelican TRUCK, HD, STREET S

106	Tubgrinder 2002 Morbark 1000 TUB GRINDER
107	Leafloader 2003 GiantVac TM6500-HW LEAF VACUU
108	Tractor 1993 John Deere 5200 TRACTOR, UTILITY,
109	Sweeper 1999 Elgin Pelican TRUCK, HD, STREET S
110	Sweeper 2002 Elgin Pelican TRUCK, HD, STREET S
111	2000 GIANTVAC TM6500HW LEAFLOADER
112	1999 GIANTVAC TM6500 LEAFLOADER
113	Leafloader 1999 GiantVac TM6500-HW LEAF VACUUM
114	Leafloader 2003 GiantVac TM6500-HW LEAF VACUUM
115	1999 GIANTVAC TM6500 LEAFLOADER
116	Leafloader 2000 GiantVac TM6500-HW LEAF VACUUM
117	2000 GIANTVAC TM6500HW LEAFLOADER
118	Skid-Steer Loader 1996 Bobcat 763H SKID STEER,
119	Bandit Chipper 1995 Bandit 250 BRUSH CHIPPER
120	1999 CHEVY S10 PICKUP
123	1995 CHEVY 2500 PICKUP
124	2001 CHEVY 2500HD 4X4 PICKUP
125	2001 3/4 Ton Truck
126	2001 CHEVY 2500HD 4X4 CREW CAB PICKUP
127	2001 CHEVY 2500HD 4X4 PICKUP
128	2000 CHEVY 3500 Dog Catcher Body
133	1994 WHITE GMC ROAD TRACTOR WG64T
134	2004 PETERBILT 320 / BRIDGEPORT RANGER 28 CU.
135	2001 CHEVY 2500HD 4X4 PICKUP
136	2004 PETERBILT 320 / NEW WAY COBRA 25YD REAR L
141	2003 GIANTVAC TM6500-HW LEAFLOADER
142	2005 Freightliner M2-106 TRUCK, HD, DUMP 5-7 Y
143	2005 Freightliner M2-106 TRUCK, HD, DUMP 5-7 Y
144	2005 ELGIN PELICAN SERIES "P" STREET SWEEPER
146	1998 BRUSH BANDIT CHIPPER 65
154	2001 1890 BRUSH BANDIT CHIPPER
300	1995 FORD CLUB WAGON XLT VAN
400	1994 DODGE MAXIVAN
404	1998 CHEVY 2500 PICKUP
2600	2003 CHEVY TAHOE
2603	1997 CHEVY SUBURBAN
2607	2003 CHEVY TAHOE*
2614	1999 SPARTAN - SAULSBURY RESCUE PUMPER
2615	1982 SUTPHEN AERIAL PLATFORM (ladder truck)
2617	2001 Chevrolet Medtec Ambulance
2618	2004 CHEVROLET 2500HD CREW CAB 4X4
2634	1996 SPARTAN - SAULSBURY RESCUE PUMPER
2637	1993 TYPE III MARK AMBULANCE E350
2697	1999 FREIGHTLINER FL50 – MEDTEC

Endnotes

[i] The reductions in waste were not included (composted and recycled waste) in the final waste value.
[ii] Energy Usage figures for Waste and Other (Wastewater and water supply) are Not Applicable (N/A).
[iii] Source: 2005 Greenhouse Gas Emissions Inventory, City of San Rafael.
[iv] Source: City of Kirkwood, Missouri Baseline Greenhouse Gas Emissions Inventory for 2008.
[v] Source: "Local Government Operations Protocol: For the quantification and reporting of greenhouse gas emissions inventories". Version 1.0.
[vi] Source: Sustainability Strategic Plan for the City of University City, Missouri.
[vii] Within this report, the Commercial and Industrial sectors have been combined due to the fact that there is little industrial activity in University City.
[viii] The total for the "Community Waste" sector does not include the presumed emissions reduction resulting from the composting of materials that would have otherwise resulting in managed landfill waste (and therefore would have emitted methane). The CACP software program does not currently allow emissions reductions to be factored in.
[ix] Denotes a rounding error.
[x] 2003 community waste data was used because it offered the most thorough and available dataset for this sector.
[xi] Note: CO_2 and N_2O emissions were disregarded in the CO_2e total because only methane, CH_4, is created in landfills.
[xii] ICLEI's default waste percentages were used. See LGOP for more information.
[xiii] Composted and recycled wastes theoretically represent emissions reductions although the CACP software is not able to account for emissions reductions and therefore, these values are disregarded when calculating total emissions. "While it is outside of the scope this Protocol to provide quantification benefits associated with these waste-reducing activities. Information about recycling and composting activities can be reported optionally. Therefore, this data was included within the report; however, the numerical values for these activities were not included in the totals for the community waste sector. ICLEI's LGOP recommends that local governments assess the potential for emissions reductions from its composting activities based on the best available data.
[xiv] A default population of 32,885 people was used for the City of University City.
[xv] This value was calculated by dividing the total community emissions from 2005, *514,362*, by the default population used throughout the report, 32,885. The value presented was rounded to two decimal places.
[xvi] Source: The World Bank Data.
[xvii] Growth factors for the Community emissions forecast were provided by East-West Gateway Council of Local Governments in conjunction with ICLEI.
[xviii] Source: "Trends in Regional Traffic Volumes: Signs of Change?" a report developed by the East-West Gateway Council of Local Governments.
[xix] It is important to remember that this total value is not added onto the total community emissions; rather this represents a portion of that total.
[xx] These facilities were respectively ranked according to total CO_2e emissions (Scope 1 + Scope 2).
[xxi] Note: Percentages are taken out of the total CO_2e emissions for **only** the Buildings & Facilities subsector (3,031 metric tons of CO_2e). Additionally, all values have been rounded to three decimal places before being multiplied by 100.0 to achieve a percentage.
[xxii] The square footage of some city-owned and operated facilities could not be found (swimming pool and ruth park pump house) and are therefore listed as "not applicable" (N/A).
[xxiii] Square footage and energy use per square foot was not included because these facilities are not fully enclosed.
[xxiv] Municipal emissions are limited to those resulting from energy use by city-owned and operated infrastructure. Approximately 217 street lights owned by Ameren and privately paid were not included within the government operations inventory for the reason stated.
[xxv] University City MO Street Lighting Study.
[xxvi] No taxes were included in the cost.
[xxvii] Account Numbers: 84252-10114 (Heman soccer field lights); 00977-05111 (Heman tennis court lights).
[xxviii] Account Number: 26400-03712.
[xxix] Account Numbers: 02990-04004; 06310-85000; 09423-07110; 10390-20003; 11813-08113; 11950-16018; 12211-64003; 13590-98002; 16551-29006; 18283-03114; 19683-02119; 25052-16113; 33517-04110; 33763-04111; 54823-05114; 78683-03114; 84113-02113; 93923-00116; 98823-05111.
[xxx] Account Numbers: 54813-09112 (Epstein Park); 12113-00116 (Lewis Park); 06400-03518 (Ackert Park); 23087-08117 (Majerus Park); 80977-05113 (Heman Park Memorial Fountain).

[xxxi] Account Number: 33331-71005.

[xxxii] Account Numbers: 84410-04610; 05410-04811; 15410-04918. Electricity usage (kWh) was estimated by Ameren based on the energy consumed by the type of light fixture and the estimated number of hours of operation in a given month.

[xxxiii] Account Number: 84410-04610. Electricity usage (kWh) was estimated by Ameren based on the energy consumed by the type of light fixture and the estimated number of hours of operation in a given month.

[xxxiv] Please see APPENDIX G on page 53 for a complete example of the city's employee commute survey.

[xxxv] Source: http://www.eia.gov/emeu/aer/txt/ptb0524.html