Richland County
Baseline Emissions Inventory

This report details the methods used and findings of the Richland County internal government operations baseline emissions inventory. The inventory is designed to be used as a tool to measure the effectiveness of energy and fuel efficiency measures and to guide decision-makers in future planning for sustainable government operations.

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Department heads throughout the County provided valuable information in terms of government operations and activity data which were a major contribution to the accuracy of inventory results. John Hixon and David Bertolini contributed to overall understanding of County operations and the Buildings & Facilities sector. Bill Peters and Jaci Ricks were responsible for all Vehicle Fleet data. Andy Metts, Ray Peterson, and Reynaldo Angoluan contributed to the Wastewater Facilities and Water Delivery sectors as well as Joey Rivers, who was gracious enough to give a tour of the Broad River Road Wastewater Treatment Plant. Alan Huffstettler provided data and information regarding solid waste operations.

SCE&G provided the majority of all electricity usage data without which the inventory would not be complete.

Anna Lange provided valuable guidance in planning and development of the inventory. As the Richland County Sustainability Manager, not only will Ms. Lange work towards improvements to County operations based on recommendations within this report, future inventories completed by Ms. Lange will continue to measure the success of those activities in her ongoing efforts to improve sustainable operations for Richland County's future.

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List of Acronyms and Abbreviations

ARB	California Air Resources Board
ANDOC %	Percent of solid waste in landfill that is decomposable
CAP	Criteria Air Pollutant
CACP	Clean Air Climate Protection software
C&D	Construction and Demolition debris
CO_{2e}	Carbon Dioxide Equivalent Emissions
DANF	Decomposable Anaerobic Fraction
EECBG	Energy Efficiency Conservation Block Grant
eGRID	Emissions and Generation Resource Integrated Database
EIA	Energy Information Administration
EMS	Emergency Management Services
EPA	Environmental Protection Agency
FOD	First Order Decay model
GHG	Greenhouse Gas
GWP	Global Warming Potential
ICLEI	International Council for Local Environmental Initiatives
IPCC	International Panel on Climate Change
LGOP	Local Government Operations Protocol
MSW	Municipal Solid Waste
NACAA	National Association of Clean Air Agencies
NAAQS	National Ambient Air Quality Standards
NERC	North American Electric Reliability Corporation
SC DHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric and Gas (A SCANA Corporation)
TDOC	Total Degradable Organic Carbon Fraction
VMT	Vehicle Miles Traveled
WWTP	Wastewater Treatment Plant

Executive Summary

Through funding received from the Energy Efficiency and Conservation Block Grant Program, Richland County began programs to reduce fuel and energy consumption and improve operational efficiency in November 2009. In order to evaluate the success of the projects funded through this grant program, an emissions inventory has been conducted as a baseline against which to measure the effectiveness of future fuel and energy efficiency efforts. The emissions measured in the inventory are a result of energy and fuel consumption. These measured emissions include both greenhouse gases and criteria air pollutants.

The overarching goal of the baseline emissions inventory project is to provide finite data on energy and fuel usage in the County in order to determine ways to reduce both costs and emissions. There are a number of benefits for the completion of an emissions inventory. Fiscal benefits include developing energy strategies that can help the County reduce energy costs and save taxpayer dollars. Conducting an emissions inventory shows exactly where energy is being used and identifies opportunities to become more efficient. Reduced energy and fuel consumption benefit the community by improving air quality and overall public health, as well as leading by example in sustainable business practices.

Inventory results reveal that, of the measured activity data, the County's operations generated 136,074 metric tons of CO_{2e} in 2009, the baseline year. This year was chosen because of the availability of data needed to complete the inventory, it was prior to implementation of any major energy or fuel efficiency upgrades, and it was a normal year in terms of government operations. Sectors for which activity data were measured include Buildings and Facilities, Outdoor Lighting, Airport Facilities, Water Delivery Facilities, Wastewater Facilities, Vehicle Fleet, and Employee Daily Commutes. The summary in Figure 1, which shows the major sources of emissions, is expounded in the remainder of this report.

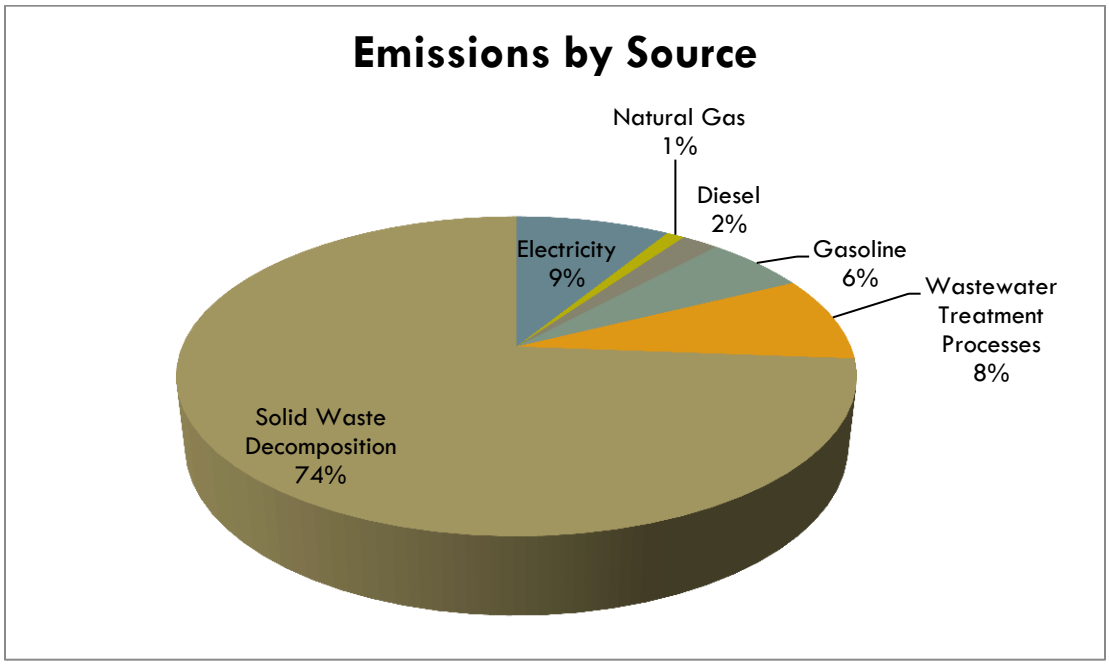


Figure 1: Richland County Government Operations Emissions by Source
Figures represented as metric tons of CO_{2e}

As Figure 1 demonstrates, solid waste decomposition constitutes the majority of emissions produced by Richland County government operations. These emissions, which consist mostly of methane, are generated

through the decomposition of organic matter as it decays over time. It is important to note here that these emissions are a function of the total amount of waste in the landfill, the composition of that waste, and the amount of time the waste has been in the landfill. Richland County's landfill has been in operation since 1974 and has accepted varying amounts of municipal solid waste, construction and demolition debris (C&D), and yard waste (e.g. grass, leaves, tree limbs). Further information on the process for estimating these emissions can be found in the Solid Waste Facilities section of this report. These emissions will continue to diminish over time as the decomposition process takes place. However, the level of these emissions should be taken into account when considering emission reduction possibilities. For example, emission reduction initiatives may include educational components for waste reduction and recycling to reduce the total waste in place in local landfills.

Opportunities also exist to reduce emissions and electricity and fuel costs in the Buildings and Facilities, Wastewater Treatment, and Vehicle Fleet sectors, which produce the majority of emissions generated from electricity and vehicle fuel consumption. As discussed in the Results portion of this report, the Buildings and Facilities sector represents the largest consumer of purchased electricity within government operations. Energy efficiency initiatives have already begun using EECBG funding. Prioritization of the facilities which consume the largest amount of electricity should play a role in future planning for these energy efficiency improvements. The recently developed Central Midlands Regional Sustainable Energy Plan addresses some of these possibilities. This baseline emissions inventory and future inventories create a documentable record of the success these initiatives have in reducing costs and emissions and developing sustainable government operations for Richland County.

Introduction

The Energy Efficiency and Conservation Block Grant Program (EECBG) is aimed at assisting US municipalities "develop, promote, implement and manage energy efficiency and conservation programs designed to: reduce fossil fuel emissions; reduce total energy usage; improve energy efficiency in transportation, buildings, and other appropriate sectors; and create and retain jobs" ("Energy Efficiency and Conservation Block Grant Program" 2010). Richland County received EECBG funding in the amount of $2,116,800 in November 2009. These funds have been used for a variety of projects and programs to include the purchase of fuel efficient vehicles, installation of energy efficient lighting and motion sensors in the Administration Complex and Judicial Center, installation of a more efficient chiller at the Alvin S. Glenn Detention Center and hot water heater at the Judicial Center, and to support a community-wide light bulb exchange to extend both cost and energy savings to County residents as well as being used as an educational component for energy efficiency. For a complete list of County EECBG funded projects, see Appendix D: EECBG Funded Projects.

In order to ensure the success of any program or project, an effective evaluation should be undertaken. The baseline emissions inventory is geared towards the evaluation of energy and fuel efficiency investments such as those funded by the EECBG program. The 2009 Richland County internal government operations inventory is an evaluation of emissions prior to the implementation of any of the EECBG funded energy and fuel efficiency projects. Therefore, the inventory should be used as a baseline against which to measure the success of these fuel and energy use reduction programs. As initiatives set forth in the Central Midlands Region Sustainable Energy Plan[1] are implemented in Richland County, future inventories will aid in the process of evaluating the effectiveness of those programs as well.

The baseline emissions inventory accounts for criteria air pollutants (CAPs) and greenhouse gases (GHGs) generated through both direct and indirect consumption of energy and fuel. Criteria air pollutants are those which are regulated by the US Environmental Protection Agency (EPA) under the authority of the Clean Air Act. CAPs, which include particulate matter and volatile organic compounds, can have severe human health impacts. It is beneficial to understand sources of these emissions now in order to develop possible reduction strategies to meet air quality standards. Greenhouse gases are naturally occurring gases which are dispersed in the atmosphere and determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence suggests that human activities are increasing the concentration of greenhouse gases, most notably the burning of fossil fuels for transportation and electricity generation which introduces large amounts of carbon dioxide and other greenhouse gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise.

The following report explains the methodology and results of the Richland County government operations baseline emissions inventory with recommendations for future inventories and possible options for emissions reductions.

[1] http://www.centralmidlands.org/pdf/Energy%20Plan%20Formatted_7-10-12.pdf

Inventory Methodology

The International Council for Local Environmental Initiatives (ICLEI) – Local Governments for Sustainability was established in 1990 and now has over 1220 members in 70 different countries. This organization has led the way in development of emissions inventory software and protocols specific to local government operations. The group also provides additional training and support resources for successful completion of an emissions inventory. As a member of ICLEI – Local Governments for Sustainability, Richland County is in the unique position to take advantage of these tools in evaluation of the jurisdiction's emissions footprint and resources for long-term emissions reduction strategies, which will in turn provide cost savings through energy and fuel efficiency projects and programs.

Local Government Operations Protocol

The Local Government Operations Protocol (LGOP) Version 1.1 was used as the basis for the methodology of the inventory data collection and reporting process. This protocol was developed collaboratively with ICLEI, the California Air Resources Board, the California Climate Action Registry, and The Climate Registry. The protocol is the official standard for all local governments wishing to complete and report an emissions inventory.

The five overarching accounting and reporting principles set forth in the protocol are relevance, completeness, consistency, transparency, and accuracy. It was the goal of the researcher in preparation of the inventory and development of this report to adhere to these principles as closely as possible in order to ensure the best possible baseline emissions inventory. Establishing a comprehensive, clear methodology in completion of the baseline inventory will help to ensure the success of future inventories. Future inventories will be the key to continuous evaluation of energy and fuel efficiency projects as the County moves forward in further sustainability efforts.

Establishing a Baseline Year

A primary component of the inventory process is choosing the baseline year. Determination of the baseline year takes into consideration:

- the availability of accurate historical data
- a year prior to the implementation of any major energy efficiency upgrades, projects or programs
- a year in which no major changes in organizational structure have occurred
- a year in which energy usage would have been normal (i.e. neither too hot nor too cold which would influence fuel and energy consumption)

After discussion of these guidelines with department heads who have contributed information and data to this inventory, 2009 was selected as the baseline year. This year precedes the major energy efficiency facility upgrades which have been funded through the EECBG. Because there were changes to the treatment of wastewater at the Broad River Road facility, additional information is included in this inventory in relation to these operational changes, which can be found in the Wastewater Facilities section of this report.

Organizational Boundaries

The LGOP provides two organizational boundary approaches for completion of an emissions inventory; the operational control approach and the financial control approach. Operational control, which indicates that emissions from any facility or activity over which "the local government has the full authority to introduce and implement its operating policies," is the recommended approach and was thus followed in completion

of this inventory (ARB et al. 2010). This approach calls for inclusion of 100% of emissions from operation of these entities (e.g. buildings, facilities, lighting, vehicles, equipment).

Although the County also has financial control over the majority of all facilities included in the inventory, operating costs were not included in this inventory because accurate, comprehensive figures for all sectors were not available. For reference, energy expense information for buildings and facilities can be found in the Master Data Workbook[2] for each individual building or facility as provided by the respective utility companies who hold the accounts. This reference should be used for comparison of costs after energy efficiency upgrades have been installed. Vehicle fleet data only included partial costs from one of the sources of data and were therefore not included. No dollar amounts were requested from employees completing the commute survey. No figures were received for disposal tonnages to the solid waste facilities.

Emission Types

ICLEI's Clean Air and Climate Protection 2009 (CACP) software was used to capture energy and fuel consumption figures, which are then converted to equivalent emissions. This software was developed through partnership with the National Association of Clean Air Agencies (NACAA) and the US Environmental Protection Agency (EPA). CACP 2009 is designed for compatibility with the LGOP thus further ensuring compliance with the five overarching principles of the protocol. Emissions which are calculated by the CACP software include greenhouse gas emissions (carbon dioxide, nitrous oxide and methane) as well as criteria air pollutants (nitrogen oxides, sulfur oxides, carbon monoxide, volatile organic compounds, PM_{10} and $PM_{2.5}$).

Criteria air pollutants (CAPs) are those which are regulated by the EPA through the Clean Air Act and the establishment of National Ambient Air Quality Standards (NAAQS). CAPs are of particular concern because of the human health consequences of increased levels of these pollutants in the atmosphere such as asthma, acute respiratory symptoms such as coughing, reduced lung function leading to shortness of breath, and chronic bronchitis, among others. CAPs are regulated by developing human health-based and/or environmentally-based criteria for setting permissible levels. EPA is required to classify areas as meeting (attainment) or not meeting (nonattainment) these standards. Therefore, understanding contributions of CAPs in the Midlands region by government operations may be useful should Richland County ever be classified in nonattainment status. The CACP software reports CAPs in lbs of each individual pollutant.

Gases that trap heat in the atmosphere are called greenhouse gases (GHGs). The four main types of GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride). The global warming potential (GWP) of each of these gases reflects the length of time the gas remains in the atmosphere, on average, and how strongly it absorbs energy relative to CO_2. Gases with a higher GWP absorb more energy, per pound, and thus contribute more to warming the planet. The CACP software converts methane and nitrous oxide to carbon dioxide equivalent emissions (CO_{2e}) using the GWP of the gas. Methane has a GWP of 21. This translates such that one metric ton of methane has 21 times the ability to absorb long-wave radiation than one metric ton of carbon dioxide. Similarly, nitrous oxide has a GWP of 310. A metric ton, or tonne, is the standard international unit of measure for GHG emissions.

[2] The Master Data Workbook, which includes all data entered into the CACP software for completion of the County's baseline emissions inventory, is available for review by request from the Richland County Sustainability Manager.

Emissions Calculation Methodology

Calculation of emissions is based on the formula:

Activity Data x Emission Factor = Emissions

Activity data is defined as the measure of fuel or energy usage. For example, fuel usage for the Vehicle Fleet sector is measured in gallons (e.g. gallons of gasoline or diesel) and energy usage for the Buildings and Facilities sector is measured in kilowatt hours (kWh) of electricity and thermal units (therms) of natural gas. Activity data are used to categorize emissions as either direct or indirect based on the scope of the activity data. This framework categorizes activity data as Scope1, Scope 2, or Scope 3 relative to the source of the emissions and provides information about the level of operational control the jurisdiction has over the emissions source. Scope 1 emissions are direct emissions from sources within a local government's organizational boundaries that the local government owns or controls. Scope 2 emissions are indirect emissions associated with the consumption of purchased or acquired electricity, heating, and cooling. Scope 2 emissions occur as a result of activities that take place within the organizational boundaries of the jurisdiction, but that occur at sources owned or controlled by another entity (e.g. SCE&G power generation facilities). Scope 3 emissions are all other indirect emissions not covered in Scope 2. See Figure 2 below for a graphical overview of scopes and emission sources.

Scope1 and Scope 2 are the essential components of the emissions inventory because they are the components over which the jurisdiction has the most control. For the purposes of this inventory, only emissions reported from the employee commute survey are categorized as Scope 3. Although the County does not have direct control over these emissions, the use of the inventory as an educational tool for employees is recommended to raise awareness of personal efforts individuals can take to reduce their own carbon footprint and improve air quality in the Midlands.

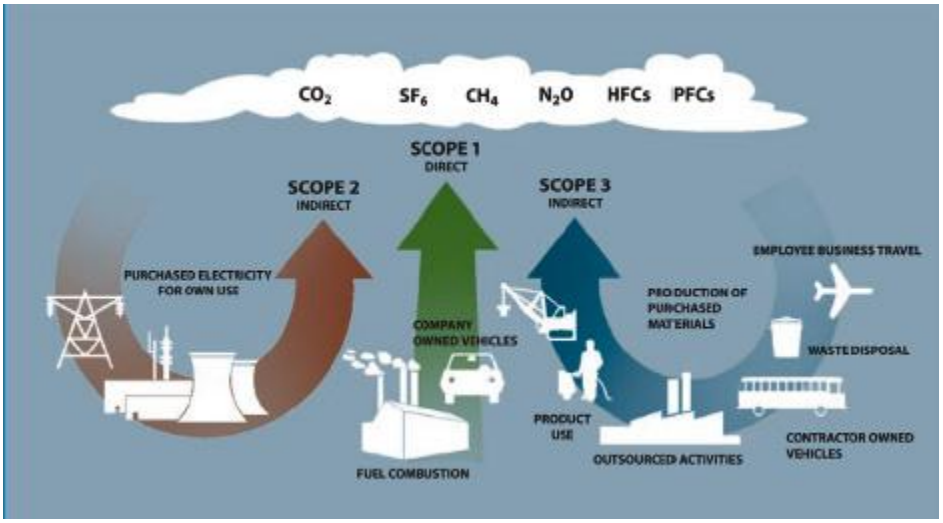


Figure 2: Overview of Scopes and Emission Sources
Source: Greenhouse Gas Protocol

Emission Factors

Emission factors are calculated ratios relating emissions to a proxy measure of activity at an emissions source and are expressed as emissions/energy used, e.g. lbs of CO_2/kWh (ARB 2010). The emission factors for greenhouse gases used for this inventory represent the electricity generation profile of South Carolina based on data in the EPA's Emissions and Generation Resource Integrated Database (eGRID). The eGRID is "a comprehensive source of data on the environmental characteristics of almost all electrical power generated in the United States. These environmental characteristics include air emissions for nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and nitrous oxide; emissions rates; net generation; resource mix; and many other attributes" ("eGRID" 2012). The eGRID is based on data gathered from the EPA, the Energy Information Administration (EIA), the North American Electric Reliability Corporation (NERC), and the Federal Energy Regulatory Commission. The eGRID2012 Version 1.0, which was released in May 2012, was used for this inventory. Emissions data from EPA are carefully integrated with generation data from EIA to produce useful values like pounds per megawatt-hour (lb/MWh) of emissions, which allows a direct comparison of the environmental attributes of electricity generation. Understanding the makeup of the County's power generation sources provides a connection between electricity consumed and emissions, which contributes to air pollution and greenhouse gas emissions. Criteria air pollutant emission factors are based on the NERC region data, which are larger regions providing larger aggregations of data in relation to the eGRID subregions used for GHG emission factors. Maps of these regions are available in Appendix A.

Emissions by Sector

In addition to categorizing emissions by scope, the inventory also reports emissions by government operations sector. This sector-based analysis can be used to better understand emissions by operation type in order to be used as a decision-support tool in developing energy and fuel efficiency projects and programs. Inventory sectors for Richland County include: Buildings and Facilities; Street Lights and Traffic Signals; Airport Facilities; Water Delivery Facilities; Wastewater Facilities; Solid Waste Facilities; Vehicle Fleet and Employee Commute. The following sections describe specific methodologies for data collection and emissions calculations for each individual sector.

The LGOP provides both *recommended* and *alternative* methods for activity data entry. The recommended approach uses exact usage data for each activity to calculate emissions and is, therefore, a more accurate representation of emissions from those respective sources. Alternative methods represent a less accurate approach as they are based on estimations of usage data. However, the availability of these alternative methods provides a standardized approach for estimating activity data in accordance with the accepted protocol.

Activity data for each individual sector were collected from various sources based on activity type (e.g. electricity usage from utility companies, fuel consumption from the Richland County fleet manager). These activity data were initially organized using the Master Data Workbook developed by ICLEI. This Excel-based workbook organizes data into sectors and provides a quality control measure to ensure that all information related to activity data is entered into a single location for ease of reference. Although notes were included in the CACP software in terms of the source of data, account numbers and any alternative methods used, the Master Data Workbook should be referenced for additional details regarding the development of the inventory. In addition, an inventory log was maintained throughout the data collection and entry process. This inventory log will also serve as a useful reference when future inventories are conducted to provide details on the development of the baseline inventory.

Per capita electricity use in South Carolina is higher than the nationwide average, due in part to high air-conditioning demand during the hot summer months and the widespread use of electricity for home heating in winter (www.eia.gov/state). Therefore, upgrades to building energy efficiency, to include HVAC units and weatherization projects, are good options for emissions reduction strategies for the County where the return on investment is sensible. ICLEI's Climate & Air Pollution Planning Tool (CAPPA) was developed to help calculate this type of cost-benefit analysis to determine next steps in emissions reduction options.

Buildings & Facilities

Emissions reported for the Buildings and Facilities sector of the inventory represent both Scope 1 and Scope 2 emissions. Activity data included in this sector are kilowatt hours (kWh) of electricity, a Scope 2 indirect emission, and thermal units (therms) of natural gas, which are Scope 1 direct emissions. SCE&G provides the majority of electricity for Richland County buildings and facilities, although there are several accounts held with Fairfield Electric Cooperative, Tri County Electric Cooperative and Mid Carolina Electric Cooperative. Notes in both the Master Data Workbook and CACP software indicate the account number associated with each building or facility and the utility contact from whom data were received. All emissions in the Buildings & Facilities sector of the inventory were calculated using the recommended method of actual usage data.

The LGOP calls for the inclusion of energy usage from leased facilities as well. Several magisterial and sheriff's department facilities fall into this category. Data were retrieved from the respective utilities for these accounts as well in order to ensure the most complete inventory possible.

Please note that buildings and facilities operated as a part of the airport, solid waste disposal and wastewater treatment are included in those respective sectors of the inventory rather than in the Buildings and Facilities sector. This provides a more accurate representation of the emissions from those unique sectors. In addition, utility accounts sometimes encompass multiple meters rather than being specific to a single building or facility. This is the case for the Broad River Road wastewater treatment plant and operations building. More information can be found about this specific case in the Wastewater Facilities section of this report.

Street Lights & Traffic Signals

Richland County operated a limited number of outdoor lights (data for 39 fixtures were provided) and one traffic signal in 2009. All outdoor lighting and traffic signal data were received from SCE&G. This data provided information on the type of lighting and number of lights at each location and the rate plan for each account. However, SCE&G does not meter specific usage for each light. Rather, costs are associated with the type of light in place and the rate plan associated with the account. Specific SCE&G rate plan information was received from John Hixon which provides estimated kWh usage per month for various types of light fixtures.

Because specific usage data were not available for the lighting accounts, the LGOP alternative method for calculating usage was used. This method uses the following calculation to estimate usage:

$$\frac{\text{Total installed wattage X Avg. annual daily operating hours X 365 (watts) (hours/day) (days/year)}}{\text{1000 (watts/kWh)}} = \text{Estimated Annual Electricity Use (kWh)}$$

This calculation was modified to use the kWh per month provided on the SCE&G rate plan for each type of light fixture, converting the calculation to kWh per month * 12 months * # of fixtures. This provides more accurate estimates of usage based on the different types of outdoor lighting in place. These calculations are included in the Master Data Workbook Public Lighting Working Data spreadsheet.

All outdoor lighting usage data were aggregated into a single entry in the CACP software. The traffic signal was entered separately.

Airport Facilities

Richland County owns and operates the Jim Hamilton – L.B. Owens Airport, although flights are managed by Eagle Aviation. Electricity usage data received from SCE&G specific to the airport hangars were included in this sector. Richland County Sheriff's Department has both an airplane and helicopter. The annual fuel usage for these aircrafts was included in this sector as well. The data received from the Sheriff's Department provided fuel usage from March 2009 to March 2010. Although not exact figures for the 2009 calendar year, this usage data was used as an approximation of annual fuel consumption.

Water Delivery Facilities

Currently there are four ground water delivery systems operated by the Richland County Utilities Department. A new system will be added in 2012, which will increase the total number of residents served. This increase in water delivery capacity should be taken into account in future inventories.

Activity data for this sector includes electricity usage for the pumps associated with these four systems. Electricity is provided by both SCE&G and Tri County Electric Cooperative with respective account information noted in the Master Data Workbook Water Transport Working Data spreadsheet. The total of these four systems was entered as a single entry in the CACP software. Please refer to the Master Data Workbook for itemized usage data.

Wastewater Facilities

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of nitrogen and carbon (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes in aerobic and anaerobic conditions lead to the creation and emission of two greenhouse gases: methane (CH4) and nitrous oxide (N_2O). Several sources of these emissions are relevant to Richland County wastewater treatment operations.

2009 was a transition year for the Richland County Utilities Department in terms of its wastewater treatment processes. The Broad River Road wastewater treatment plant (WWTP) came online in full capacity in December of that year. Prior to this, an open lagoon was used for wastewater treatment at the Broad River Road site. The Lower Richland WWTP is also in operation in Eastover, SC under the jurisdiction's control. Excel calculation spreadsheets provided by ICLEI, which are based on the methodologies provided in the LGOP, were used to estimate emissions from these three separate processes and are available for review in the Master Data Workbook.

Because the Broad River Road WWTP uses electricity that was not necessary for operation of the lagoon, future emissions inventories should consider this change to operations when evaluating emissions from the Wastewater Facilities sector. Please see Appendix B for recent historical electricity usage information for this account. In order to use a nitrogen reading that is representative of emissions with the WWTP in

operation, which is more efficient than the lagoon, the reading for December 2009 was used to estimate N_2O emissions for this site per recommendations from ICLEI support staff.

In addition to the increased electricity usage by the WWTP, a sludge drier was installed at this location in 2011. Electricity usage for this drier is not included in this inventory, but should be included in future inventories with consideration that this equipment was not present in the baseline year when evaluating emissions for this sector. The Utilities Department is currently working with SC DHEC to permit the dried sludge as organic compost. This compost would then be saleable commercially. There is also an opportunity to use the sludge as an organic cover at the Richland County landfill.

Electricity usage for lift stations and pumps, which operate in conjunction with the wastewater treatment plants, were aggregated for entry into the CACP software. For a list of itemized usage by lift station, please see the Master Data Workbook WW-Energy Use Working Data spreadsheet.

Solid Waste Facilities

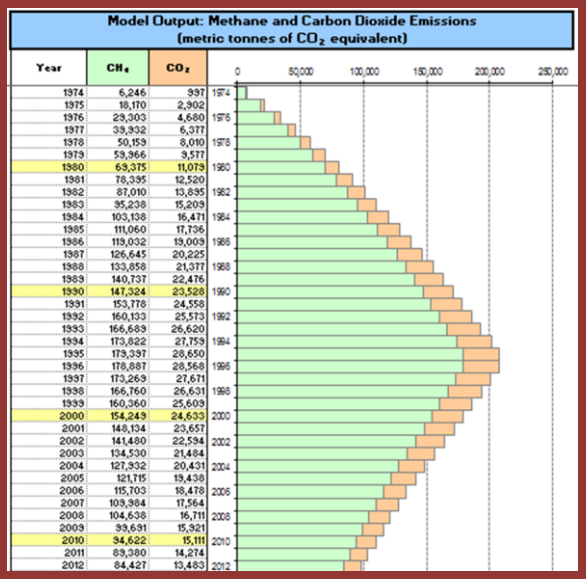
The most prominent source of greenhouse gas emissions from solid waste facilities is fugitive methane released by the decomposition of organic waste over time in landfills. After being placed in a landfill, organic waste (such as paper, food scraps, and yard trimmings) is initially decomposed by aerobic bacteria. After the oxygen has been depleted, the remaining waste is available for consumption by anaerobic bacteria, which break down organic matter into substances such as cellulose, amino acids, and sugars. These substances are further broken down through fermentation into gases and organic compounds that form the substrates for the growth of methanogenic bacteria. These CH_4-producing anaerobic bacteria convert the fermentation products into stabilized organic materials and biogas consisting of approximately 50% CO_2 and 50% CH_4, by volume (ARB et al. 2010).

The scale of these emissions depends upon the size and type of the landfill. The Richland County landfill has been in operation since 1974 and has accepted varying amounts of municipal solid waste, construction and demolition waste, and yard waste (e.g. grass, leaves, limbs, etc.). Other emissions included in this sector are from electricity used to generate power for solid waste management facilities.

An estimate of methane emissions from the County's landfill was calculated using the First Order Decay (FOD) model developed by the California Air Resources Board. This model is based on the

Richland County Landfill GHG Emissions

Below is a representation from the ARB Landfill Emissions Tool v1.3 of estimated methane and carbon dioxide emissions generated by the Richland County landfill from 1974 to 2012.



Model Output: Methane and Carbon Dioxide Emissions (metric tonnes of CO_2 equivalent)

Year	CH_4	CO_2	
1974	6,246	397	1974
1975	18,170	2,302	1975
1976	29,303	4,680	1976
1977	39,932	6,377	1977
1978	50,159	8,010	1978
1979	59,366	9,577	1979
1980	69,375	11,079	1980
1981	78,395	12,520	1981
1982	87,010	13,895	1982
1983	95,238	15,209	1983
1984	103,138	16,471	1984
1985	111,060	17,736	1985
1986	119,032	19,009	1986
1987	126,645	20,225	1987
1988	133,858	21,377	1988
1989	140,737	22,476	1989
1990	147,324	23,528	1990
1991	153,776	24,558	1991
1992	160,133	25,573	1992
1993	166,689	26,620	1993
1994	173,822	27,759	1994
1995	179,397	28,650	1995
1996	178,887	28,568	1996
1997	173,263	27,671	1997
1998	166,760	26,631	1998
1999	160,360	25,609	1999
2000	154,243	24,633	2000
2001	148,134	23,657	2001
2002	141,480	22,594	2002
2003	134,530	21,484	2003
2004	127,332	20,431	2004
2005	121,715	19,438	2005
2006	115,703	18,478	2006
2007	109,384	17,564	2007
2008	104,638	16,711	2008
2009	99,691	15,921	2009
2010	94,622	15,111	2010
2011	89,380	14,274	2011
2012	84,427	13,483	2012

As the image demonstrates, emissions naturally reduce over time as organic matter in disposed waste continues to decompose. In addition, total tonnage disposed of in this particular landfill has decreased during its operation and the current waste profile contains less biodegradable organic matter than traditional municipal solid waste.

There is opportunity to use this information as an educational component for County residents in waste reduction and recycling initiatives to decrease these same emissions in other landfills located throughout the Midlands region.

IPCC FOD model which was developed for national governments to quantify waste emissions. The model uses variables for the waste-in-place, the percent of the waste that is decomposable (ANDOC %), the total degradable organic carbon fraction (TDOC) of the waste component, and the decomposable anaerobic fraction (DANF) of the waste component to calculate methane emissions. The default ANDOC% values in the ARB FOD model are for municipal solid waste (MSW) only. Because the Richland County landfill accepts construction and demolition (C&D) debris and yard waste, the ANDOC % value was modified for years in which waste composition data was available (1993 – present). Using these modified ANDOC% values not only represents a more accurate estimate of emissions, but also lowers the estimate of emissions because C&D and yard waste do not contain the decomposable organic matter present in traditional MSW.

Although the recommended method for activity data entry into the FOD model is to use exact tonnages disposed of in the landfill, estimations based on population served are acceptable as an alternative method. Disposed tonnages are available from 1993 to present. Population estimates from the US Census Bureau were used to estimate the annual disposal tonnage to the facility from 1974 to 1992, according to LGOP guidelines. The waste profile of Phase 1 of the landfill, in use from 1974 to 1997, was mainly MSW, with C&D disposal from 1994 to 1995; therefore, default ANDOC% values were used for emissions estimates during the years for which the waste composition profile is not available. Data used for entry into the ARB Landfill Emissions Tool are available in the Excel workbook titled 'Solid Waste Data,' available by request from the Sustainability Manager.

Vehicle Fleet

The combustion of fossil fuels in vehicles results in emissions of both GHGs and CAPs. GHG's emitted include CO_2, CH_4, and N_2O. Calculation of CO_2 emissions is best determined using fuel consumption data because CO_2 emissions are the result of the combustion of fossil fuels. CH_4 and N_2O emissions are best calculated based on vehicle miles traveled because these emissions depend on emission control technologies employed in different types of vehicles.

Fuel usage data were available from the tracking systems employed by the fleet management division of Support Services. However, vehicle miles traveled are not consistently tracked. Therefore, the LGOP alternative method of estimating vehicle miles traveled based on the fuel economy of each vehicle and corresponding fuel usage was employed. These calculations can be found in the Master Data Workbook VF-VMT Final Alt Methods spreadsheet. Fuel economies for vehicles were found on the EPA website www.fueleconomy.gov. Fuel economies for heavy duty vehicles (e.g. Public Works dump trucks and fire engines), for which no figures were available, were based on defaults provided in the LGOP based on vehicle weight. This is not applicable for off road equipment, for which all emissions were calculated based on fuel consumption.

Three different tracking systems are used by Fleet Management to record fuel usage for the various County vehicles: the Trak system, Fuelman, and the City of Columbia's reporting system (used by EMS vehicles). These data were provided in three separate spreadsheets and combined into a single spreadsheet, organized by County department. Not all vehicle unit numbers were included in these spreadsheets. Departmental vehicle inventories were cross-referenced in order to organize fleet data as accurately as possible. Vehicles were organized in the Master Data Workbook and entered into the CACP software by department in order to provide results representative of each department rather than different types of vehicles.

Employee Commute

The Employee Commute is the only Scope 3 sector included in the inventory over which the County has no direct operational control. However, conducting the employee commute and sharing the data provides an excellent opportunity for public education and outreach to address issues of emissions, air quality and the public health component with employees.

A copy of the questionnaire is included in Appendix C. Data gathered included mode of transportation used to commute to work; vehicle make, model and model year; vehicle miles traveled to work each day; and a request to indicate level of interest in a carpool and/or ride share program. Emissions calculation methodologies were similar to those for the Vehicle Fleet sector. However, in lieu of requesting total fuel usage to commute to work, employees were asked to document their vehicle miles traveled (VMTs). Therefore, opposite of Vehicle Fleet calculations, Employee Commute calculations for CH_4 and N_2O were based on documented activity data while CO_2 emissions were calculated from the VMTs using the provided vehicle make and model year. See the Master Data Workbook EC-Working Data spreadsheet for these calculations.

A total of 42% of employees responded to the survey, traveling an estimated 3,207,160 miles to work annually. A number of employees who are on call after regular working hours, such as Sheriff's deputies and Utilities Department employees, drive County vehicles home. In order to avoid double counting, any survey responses indicating that the employee drove a County vehicle were not included in the aggregation of commute data because they are included in Vehicle Fleet sector emissions. 97% of the employees who responded to the survey drive alone to work each day, 2% carpool, 2 respondents take public transportation and 1 employee walks 1 mile. 84% of respondents travel fewer than 25 miles to work (one way), with 25% traveling between 6 and 10 miles to work each day. The median miles traveled to work each day is 14. 59% of respondents drive passenger cars and 40% drive light trucks to include SUVs.

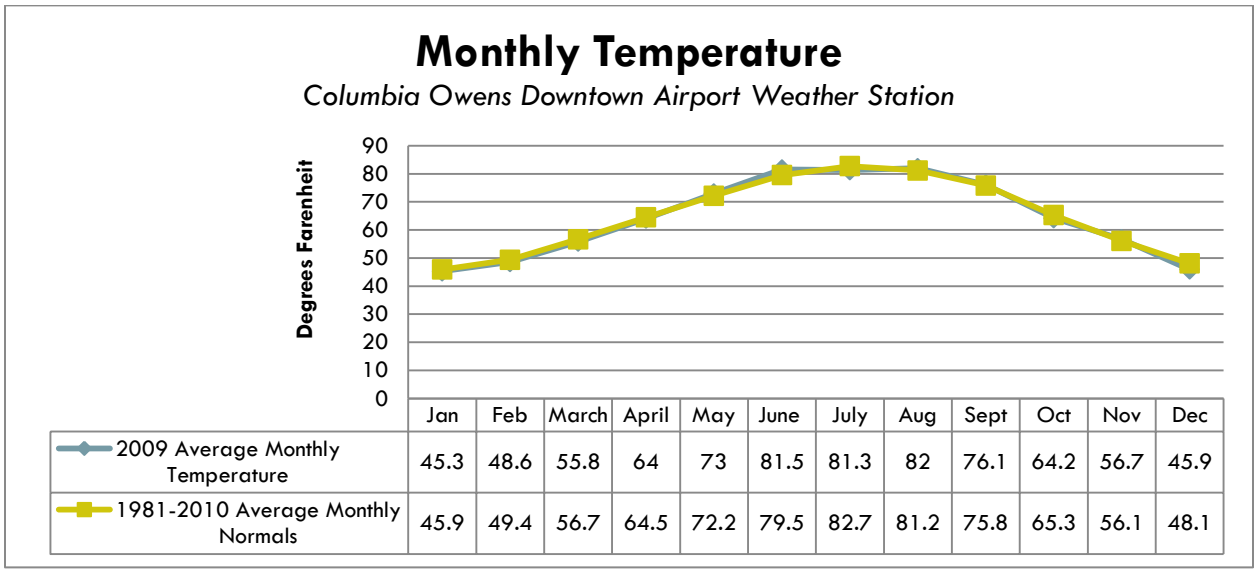
The Richland County Light Bulb Exchange, one of the County's EECBG-funded programs, allowed over 13,000 incandescent bulbs to be removed from use in residents' homes, recycled, and replaced with energy efficient compact florescent bulbs. Not only are residents able to save energy and money on their electric bills, the program has also been the source of communication and outreach with citizens about the role they play in reducing energy use in the Midlands. Similarly, results of the Employee Commute Survey can be used as an educational tool to demonstrate how each County employee is able to contribute to reduced personal expenses and cleaner air by carpooling, walking, riding a bike or taking public transportation to work when possible.

Inventory Results

Government Operation Figures

It is important to consider the scale of operations and the size of the community Richland County municipal government serves in relation to the emissions generated. Richland County encompasses approximately 757 square miles in the center of the state of South Carolina and includes the 132 square mile jurisdictional boundary of the City of Columbia within this area ("Richland County Quick Facts"). Richland County is in the Department of Energy's Climate Zone 3, which is a consideration taken into account in the agency's development of building energy efficiency codes.

Average annual rainfall for the area is 46 inches and the average mean temperature is 66.7° F ("Richland County Climate Data"). Figure 3 below shows the average monthly temperature for 2009 in comparison to the 30 year normals. Average temperatures were consistent in 2009 with normals. This information is provided to demonstrate that 2009 was not exceptional in relation to the average temperature in the area. This is an important factor in choosing a baseline year because climate variables such as higher or lower than average temperatures may lead to increased electricity consumption in jurisdictional facilities for heating or cooling purposes, in turn yielding higher emissions from electricity generation and an inaccurate baseline emissions inventory for comparison with future inventories.



	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2009 Average Monthly Temperature	45.3	48.6	55.8	64	73	81.5	81.3	82	76.1	64.2	56.7	45.9
1981-2010 Average Monthly Normals	45.9	49.4	56.7	64.5	72.2	79.5	82.7	81.2	75.8	65.3	56.1	48.1

Figure 3: Richland County Average Monthly Temperature
Source: NOAA National Climate Data Center

In 2009, Richland County government employed 1,926 people[3] and served an estimated 380,245 residents ("Richland County Quick Facts"). The fleet consisted of 1,123 vehicles, 5,388,786 gallons of drinking were delivered to residents, and over 600 million gallons of wastewater were treated.

[3] This figure represents the average number of employees, including part-time, determined per OSHA requirements, as the employee count changes each pay period. Information received from David Chambers, Richland County's Risk Manager.

Results by Sector

The data collected for the baseline emissions inventory reveals an estimated 136,074 metric tons of CO_{2e} were emitted through Richland County government operations in 2009. This total is broken down into each respective operating sector included in the inventory in Figure 4 below. 11,734 metric tons of CO_{2e} emissions are attributable to the Buildings and Facilities sector, 11,669 metric tons to the Wastewater Facilities sector, and 10,902 metric tons to the Vehicle Fleet sector. However, by far the largest emitter of greenhouse gas emissions in Richland County is methane production caused by decomposition of waste in the landfill, contributing 99,719 metric tons of CO_{2e} emissions (73%) in 2009. It is noteworthy to reiterate here that methane has a GWP of 21 times that of carbon dioxide. Therefore, each tonne of methane emitted has 21 times the warming capacity of 1 tonne of CO_2.

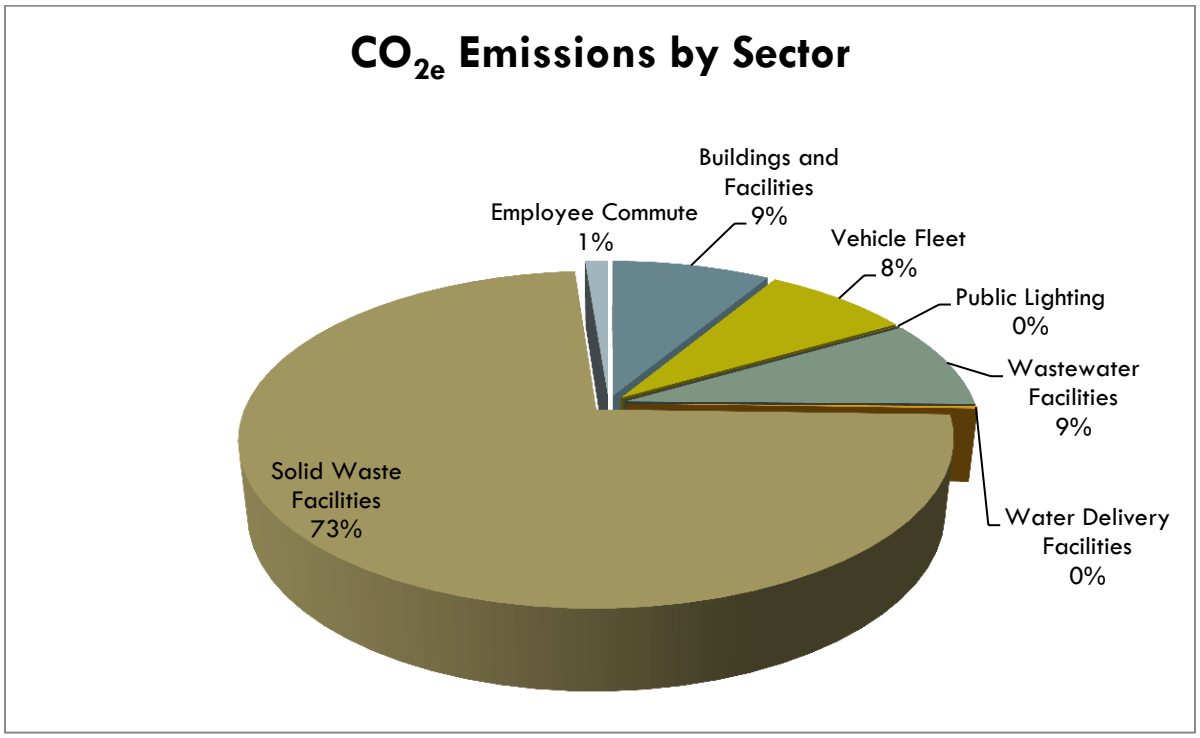


Figure 4: Total 2009 Greenhouse Gas Emissions by Sector

Figure 5 below shows the breakdown of emissions by sector excluding the Solid Waste sector. This graph more clearly shows that the Buildings and Facilities Sector, Wastewater Facilities sector, and Vehicle Fleet sector contribute an approximately equal amount of emissions, although each through very different types of operations.

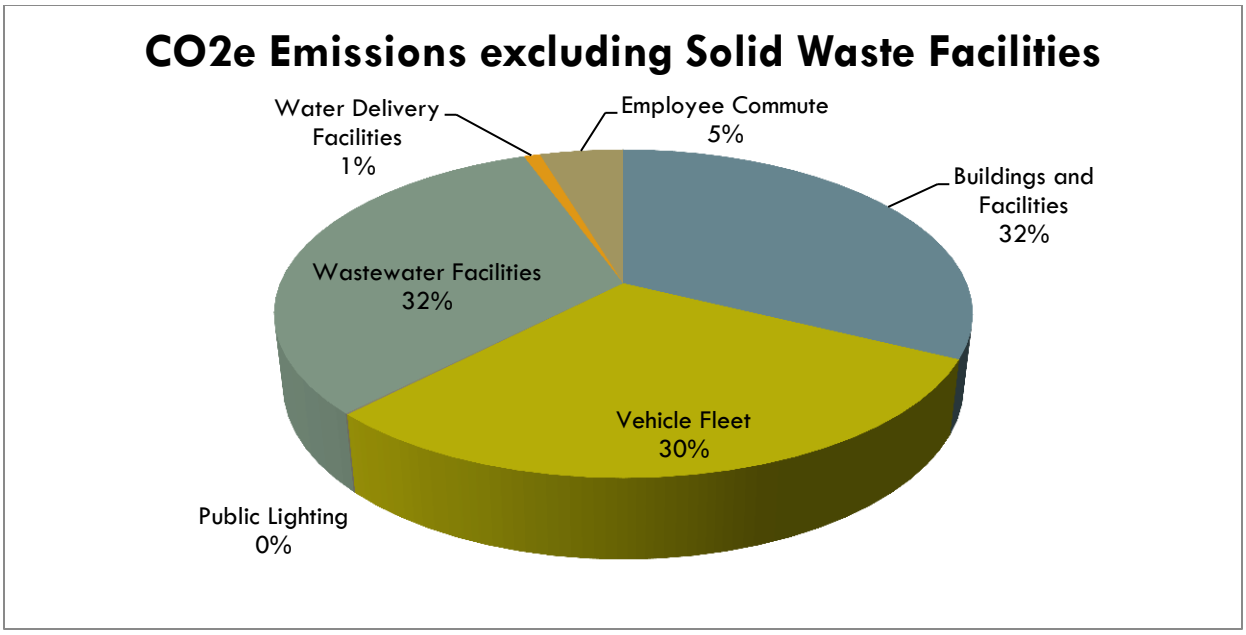


Figure 5: Greenhouse Gas Emissions by Sector Excluding Solid Waste Emissions

Criteria Air Pollutant Emissions

Criteria air pollutant emissions by sector are presented in Table 1 below. Because each criteria air pollutant is different and contributes to the degradation of air quality by different means, these figures are not aggregated to be presented graphically. For example, volatile organic compounds (VOCs) are the precursors to ozone and produced primarily through the combustion of fossil fuels in vehicles; therefore, we see the majority of these emissions in the Vehicle Fleet and Employee Commute sector. More information can be found on the role various CAPs play in air quality from the SC Department of Health and Environmental Control[4] and the US Environmental Protection Agency[5].

Table 1: Criteria Air Pollutants by Sector

Sector	NOx	SOx	CO	VOC	PM10
Buildings and Facilities	19,282	177,481	5,202	699	3,675
Streetlights & Traffic Signals	51	605	14	2	12
Airport Facilities	265	3,156	72	8	63
Water Delivery Facilities	46	551	13	1	11
Wastewater Facilities	1,749	20,809	478	54	416
Solid Waste Facilities	41	483	11	1	10
Vehicle Fleet	75,136	4,813	586,654	63,617	3,548
Employee Commute	10,905	632	118,238	12,331	241
Total	107,475	208,530	710,682	76,714	7,975

[4] http://www.scdhec.gov/environment/baq/AirPollutants/specific_pollutants.asp
[5] http://www.epa.gov/air/airpollutants.html

Results by Scope

Because there are clear distinctions in the sectors which contribute most to Scope 1 and Scope 2 emissions in the County, addressing these largest contributors is the logical next step in reducing overall emissions for the County.

Scope 1 GHG Emissions

Figure 6 provides a graphical depiction of Scope 1 emissions by sector. The Richland County landfill produces the largest amount of Scope 1 direct GHG emissions. As noted previously, these emissions consist of methane produced through the natural decomposition of waste disposed of in the landfill. The level of methane emissions is a function of the waste in place, the composition of the waste, and the amount of time the waste has been in the landfill. Methane production diminishes over time as organic matter continues to decay. Therefore, a combination of reduced tonnage disposed of in the Richland County landfill and the passage of time will eventually deplete the amount of methane produced at this site. However, there may be opportunities for collection of methane emissions to reduce their release into the atmosphere. An evaluation of the feasibility for landfill gas collection options is recommended.

Wastewater treatment facilities account for the second largest amount of direct Scope 1 emissions, which consist mostly of methane produced by the lagoon. Because the lagoon is no longer operational, these emissions have already been reduced drastically.

The Vehicle Fleet sector accounts for the third largest amount of direct Scope 1 emissions. CO_2 emissions are produced through fuel consumption, while CH_4 and N_2O emissions are a function of vehicle miles traveled based on emissions control technologies in each vehicle. This is not applicable for off road vehicles such as equipment used by the Public Works department, for which all emissions are calculated based on fuel consumption. Figure 7 below shows Vehicle Fleet emissions by department for the four largest contributing departments. Logically, the Sheriff's Department, which has the largest inventory of vehicles, produces the most emissions in this sector. The drastic reduction of emissions from this department to the Utilities Department shows the relationship between number of vehicles in the department and emissions. Because the presence of Sheriff's deputies plays a vital role in the safety of Richland County communities, reducing the number of vehicles in this fleet would not be the best way to reduce emissions from this sector. The purchase of more fuel efficient vehicles with better emission control technologies would be a better solution. This is also true for departments whose employees are on call after regular business hours in order to be readily available should an emergency arise, such as the Utilities Department. Other departments may be better able to reduce miles traveled or fuel consumed by eliminating any idling time, carpooling to meetings or conferences, or even teleconferencing for meetings when this is a viable option to reduce the necessity of driving completely.

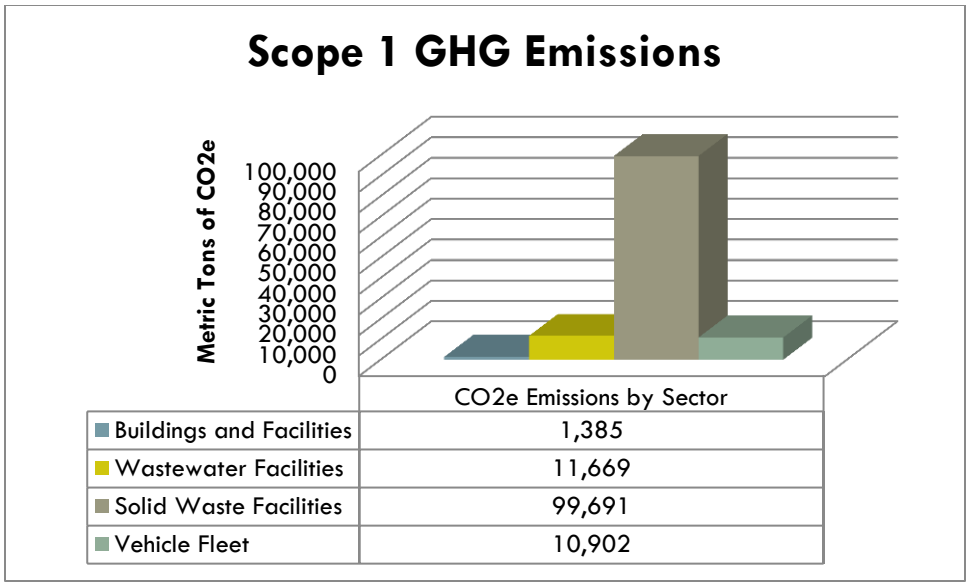


Figure 6: Scope 1 Direct GHG Emissions by Sector

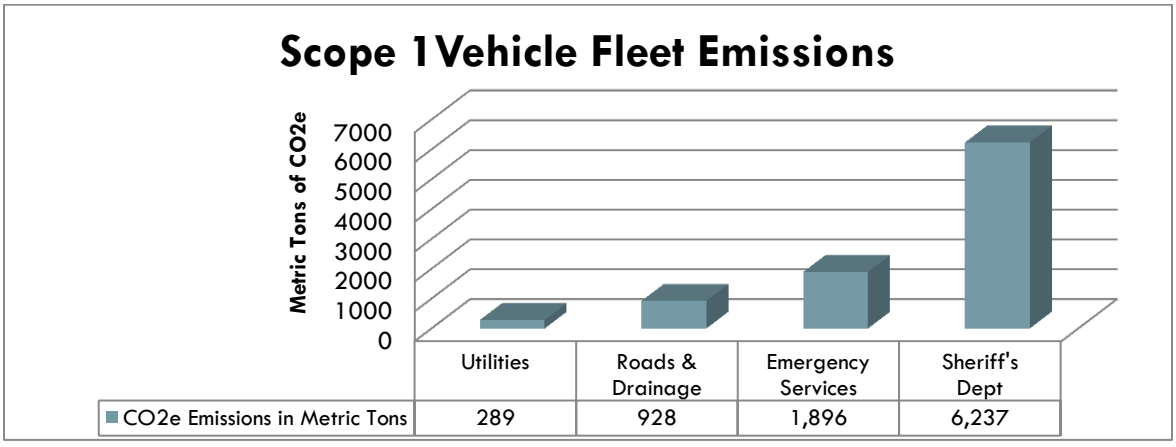


Figure 7: 4 Largest Contributors to Scope 1 Emissions in the Vehicle Fleet Sector

Scope 2 GHG Emissions

Richland County buildings and facilities produce the largest amount of Scope 2 emissions of those included in the baseline inventory. Scope 2 indirect emissions are the result of purchased electricity, thus this result is fairly logical. Purchased electricity within the Wastewater Facilities sector includes the using of electricity within the wastewater treatment process. As mentioned previously, electricity usage has increased within this sector since the baseline year as a result of the new Broad River Road WWTP and installation of the sludge drier. However, other Scope 1 emissions will be offset through the use of the WWTP in lieu of the open lagoon. Figure 8 below shows Scope 2 emissions by sector.

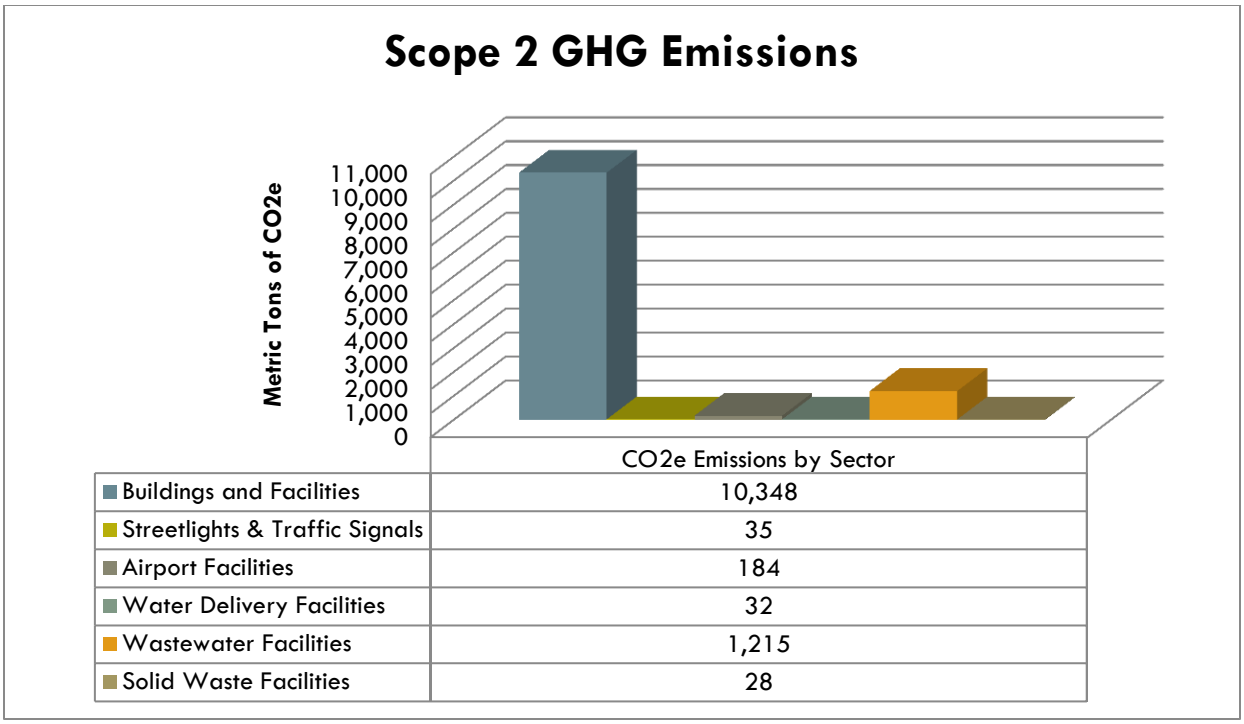


Figure 8: Scope 2 GHG Emissions by Sector

Figure 9 shows the breakdown of Scope 2 emissions by department for the Buildings and Facilities sector. Energy efficiency upgrades have already begun for several facilities using EECBG funds. Further information about these upgrades can be found in Appendix D. In addition, the County's Sustainability Manager, Anna Lange, is using the EPA ENERGY STAR Portfolio Manager Tool to track electricity consumption in buildings where energy efficiency improvements have been made.

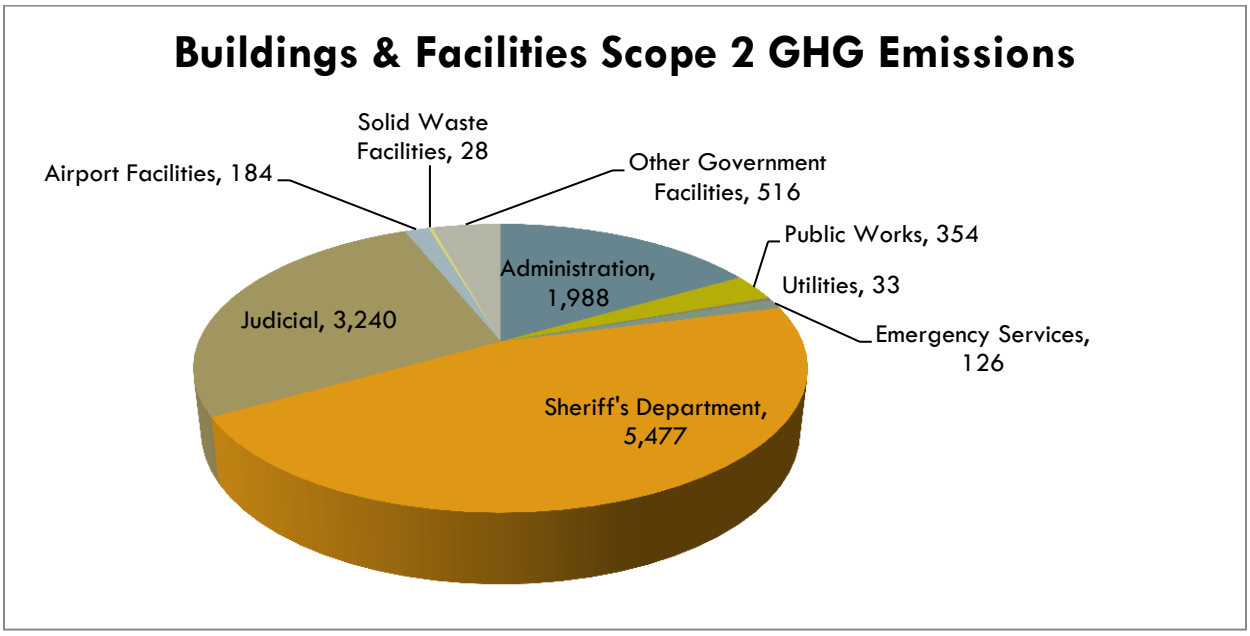


Figure 9: Buildings & Facilities Sector Scope 2 GHG Emissions by Department
Figures in metric tons of CO2e

Figure 10 shows the 5 largest contributing facilities to emissions in the Buildings and Facilities sector. The Alvin S. Glenn Detention Center is the specific facility within the Sheriff's Department which consumes the most electricity, due to 24/7/365 operations. This building has, thus far, not been included in energy efficiency improvements. Although there are special considerations for the detention center dictated by safety and operations, the results of the baseline inventory suggest that this facility should be prioritized for upgrades and improvements as additional funding becomes available.

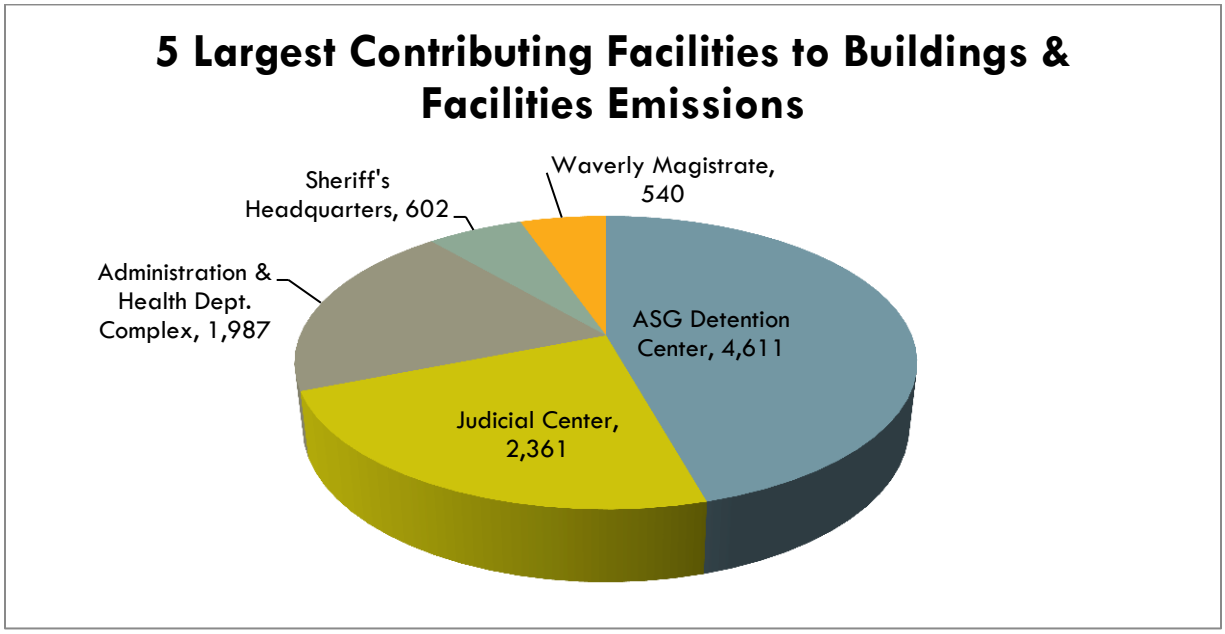


Figure 10: Top 5 Buildings and Facilities for Energy Consumption
Figures in metric tons of CO2e

Uncertainty in the Inventory

It is important to note that any emissions inventory is an estimation and not an exact measure of emissions. This is because emissions are calculated from activity data as opposed to direct measure of the emissions. In addition, specific activity data are not always available (i.e. vehicle miles traveled for the Vehicle Fleet sector). However, the Richland County baseline emissions inventory data collection and quality control process took this uncertainty into account. The LGOP was followed in order that the process of completing the inventory was consistent with other inventories developed throughout the country and in order that future inventories are comparable to the baseline inventory by following this same protocol.

If any major changes are implemented in the LGOP prior to the next inventory taken, the baseline emissions inventory should be re-calculated in order to ensure consistency with future inventories. In addition, departments which are able to improve their record keeping process in order to supply recorded activity data will in turn aid in improvement of future inventories.

Future Use of the Baseline Emissions Inventory

Although baseline emissions inventories have also been completed in South Carolina for several jurisdictions, to include the City of Columbia, Greenville County and Charleston, the emissions reported by these various jurisdictions are not comparable because of differences between type and size of government operations. For example, the City of Columbia's inventory revealed that the water delivery system is the largest emitter of greenhouse gas emissions amongst their operation sectors because of the large amount of energy required for the water treatment and delivery processes. The City of Columbia provides water to all City of Columbia residents as well as the vast majority of Richland County residents. Thus, the water sector of the County's inventory only represents a fraction of the County's emissions profile in comparison. Taking these discrepancies into consideration, the best use of the baseline emissions inventory will be in comparison to future inventories for Richland County in order to measure the effectiveness of energy and fuel efficiency projects and programs, rather than comparison with other jurisdictions.

Completion of a baseline emissions inventory is the first milestone in ICLEI's *5 Milestone Process for Climate Mitigation*. The next four steps are to: 2) Establish a Reduction Target; 3) Develop a Climate Action Plan; 4) Implement the Climate Action Plan; 5) Monitor/Evaluate Progress. The emissions reduction target should consider growth in scale and/or scope of government operations and the number of residents served by these operations. Richland County has worked in conjunction with the City of Columbia and Lexington County to develop the Central Midlands Regional Sustainable Energy Plan. Although not specifically a climate action plan as defined by ICLEI, many of the measures set forth in this plan will work to reduce emissions by Richland County government operations, which will aid in meeting an emissions reduction target. Future inventories are the best measure for monitoring and evaluating progress in reaching the reduction target. In addition to these inventories, the current use of the EPA's ENERGY STAR Portfolio Manager Tool will help to measure progress in reducing energy consumption at more regular intervals without the undertaking necessary in completing an emissions inventory.

Although the largest emitters of GHGs may not necessarily be what are considered 'low-hanging fruit' for emissions reduction options (i.e. methane capture and reuse at the solid waste landfill), opportunities for addressing these emissions sources should be considered. In addition to direct reduction of emissions, public education and outreach cannot be underestimated as a means for improving sustainability in government operations. For example, waste reduction and recycling initiatives can help to reduce the amount of waste being disposed of in the landfill, in turn reducing the amount of organic waste in place which generates methane emissions. Currently, most MSW from Richland County residents is disposed of in other, privately operated landfills. However, having calculated emissions from Richland County's landfill, it is easy to imagine the additional emissions generated by these multiple other operating facilities, further emphasizing the need for waste reduction measures.

The employee commute survey, which included an inquiry of interest in a carpool/rideshare program, can also be used as an educational piece. Publication of results of the questionnaire, to include such things as the total annual vehicle miles traveled by employees, may be surprising to employees who have not considered alternative means of transportation for their commute. Gallons of fuel consumed could be converted to a ballpark estimate of costs based on current fuel prices. In many instances, personal cost savings are the best motivation for individuals when it comes to fuel and energy efficiency opportunities.

EECBG funds used to improve energy efficiency in Richland County facilities are already showing impressive reductions in energy consumption. Because electricity rates from SCE&G are set to increase

over the next five years, these reductions in consumption will help to offset the rising cost of electricity. By laying the groundwork through the baseline emissions inventory, reduction target, and climate action planning process, Richland County will have the ability to select and prioritize the very best emissions reduction measures. Finally, by periodically updating inventories, creating new baselines, and adding new initiatives to fuel and energy efficiency plans, the County will be able to track and report progress in protecting the climate and demonstrate reductions in emissions. Ultimately, any fuel or energy efficiency project or program will benefit the triple bottom line of people, profit and planet and provide County residents with beneficial, sustainable services for the future.

Works Cited

"Air Topics: Laws and Regulations." *EPA*. Environmental Protection Agency, 26 June 2012. Web. 07 Aug. 2012. <http://www.epa.gov/lawsregs/topics/air.html>.

California Air Resources Board (ARB), California Climate Action Registry (CCAR), ICLEI - Local Governments for Sustainability (ICLEI), and The Climate Registry. *Local Government Operations Protocol For the Quanitificaiton and Reporting of Greenhouse Gas Emissions Inventories*. Boston: ICLEI - Local Governments for Sustainability, May 2010. PDF.

"Cleaning Up Commonly Found Air Pollutants | Plain English Guide to The Clean Air Act." *EPA*. Environmental Protection Agency, 6 Mar. 2012. Web. 07 Aug. 2012. <http://www.epa.gov/air/caa/peg/cleanup.html>.

"EECBG State and Local Grant Allocations." *Weatherization and Intergovernmental Program:*. US Department of Energy, 13 Apr. 2010. Web. 06 Aug. 2012. <http://www1.eere.energy.gov/wip/eecbg_state_allocations.html>.

"EGRID." *Clean Energy*. Environmental Protection Agency, 10 May 2012. Web. 7 Aug. 2012. <http://www.epa.gov/cleanenergy/energy-resources/egrid/>.

"Energy Efficiency and Conservation Block Grant Program." *Weatherization and Intergovernmental Program:*. US Department of Energy, 29 Sept. 2010. Web. 06 Aug. 2012. <http://www1.eere.energy.gov/wip/eecbg.html>.

"Greenhouse Gas Emissions: Greenhouse Gases Overview." *EPA*. Environmental Protection Agency, 14 June 2012. Web. 07 Aug. 2012. <http://www.epa.gov/climatechange/ghgemissions/gases.html>.

ICLEI Global: About. ICLEI - Local Governments for Sustainability, n.d. Web. 6 Aug. 2012. <http://www.iclei.org/index.php?id=about>.

Killigrew, J.R. "Preliminary Findings." Message to the author. 2 Aug. 2012. E-mail.

Monthly Climatological Summary January - December 2009 Columbia Owens Downtown Airport, SC US. Asheville: NOAA National Climatic Data Center, 9 Aug. 2012. PDF.

"Richland County Climate Data." *South Carolina State Climatology Office*. South Carolina Department of Natural Resources, n.d. Web. 09 Aug. 2012. <http://www.dnr.sc.gov/climate/sco/ClimateData/countyData/county_richland.php>.

"Richland County Quick Facts." *State and County Quick Facts*. United States Census Bureau, 7 June 2012. Web. 9 Aug. 2012. <http://quickfacts.census.gov/qfd/states/45/45079.html>.

Summary of Monthly Normals 1981-2010 Columbia Owens Downtown Airport, SC US. Asheville: NOAA National Climatic Data Center, 9 Aug. 2012. PDF.

Appendix A: EPA eGRID Subregions and NERC Regions

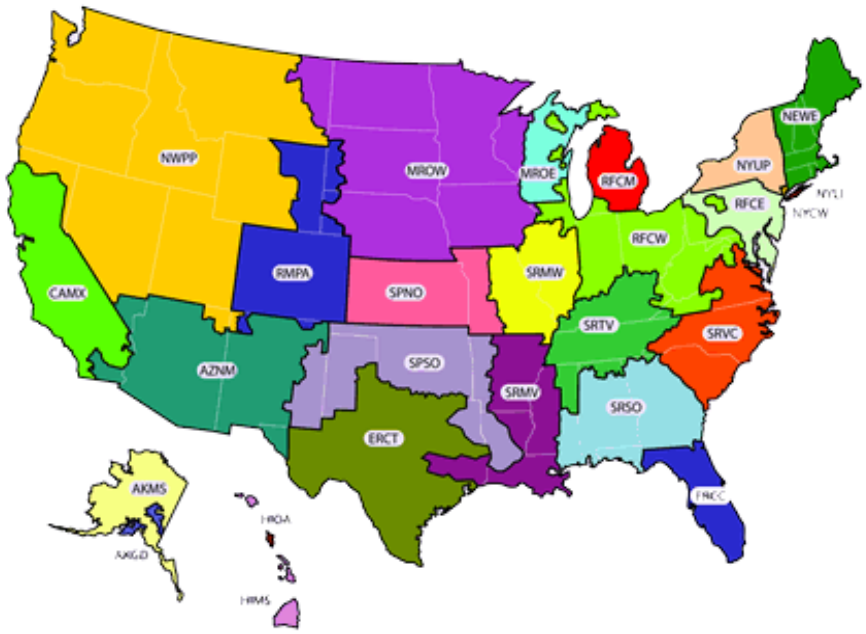


Figure 11: EPA eGRID Subregions
Source: EPA

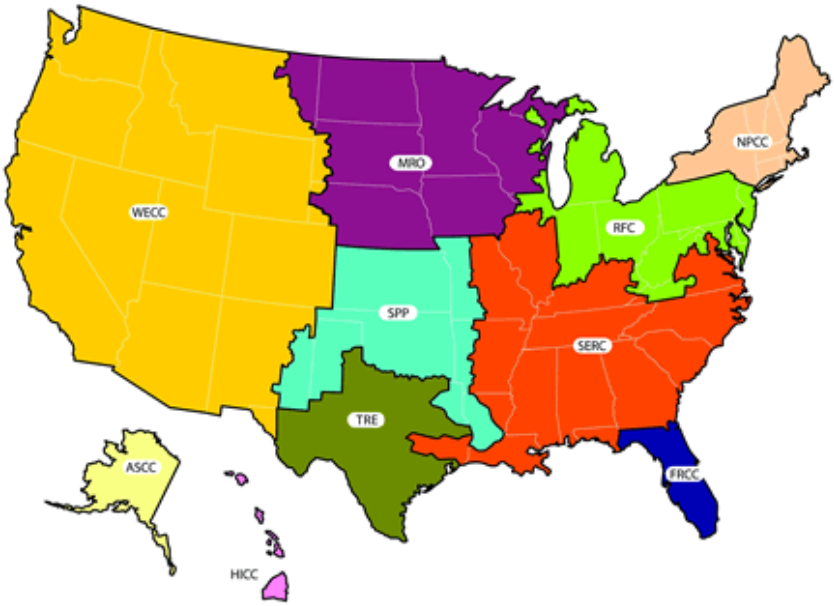


Figure 12: NERC Regions
Source: EPA

These are representational maps; many of the boundaries shown on the maps are approximate because they are based on companies, not on strictly geographical boundaries.

Appendix B: Electricity Usage from the Broad River Road Wastewater Treatment Site, January 2009 – May 2012

Table 2: Broad River Road Site Electricity Usage, January 2009 - May 2012

	2009	2010	2011	2012
	Usage	Usage	Usage	Usage
JAN	94,80031	252,40031	330,80031	306,00031
FEB	98,00031	331,60031	320,40031	320,80031
MAR	65,60028	321,20028	262,80028	291,20029
APR	48,80031	377,20032	270,80031	324,40031
MAY	38,00029	294,80030	254,00030	295,20030
JUN	42,40031	328,00031	277,60031	
JUL	30,00030	304,80030	307,60030	
AUG	45,60031	307,20031	281,20031	
SEP	47,20031	296,40031	288,80031	
OCT	43,20030	271,20030	268,40030	
NOV	53,20031	287,20031	292,40030	
DEC	112,40030	316,00030	271,60029	

Source: Mid Carolina Electric Cooperative
Mid Carolina Account Number: 6801187391

Appendix C: Employee Commute Survey

Richland County Government

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Columbia, SC 29202

Phone: (803) 576-2016
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TDD: (803) 748-4999

Office of the County Administrator

Employee Commute Survey

The purpose of this survey is to gather information on your work commute each day. The survey is part of the Richland County baseline emissions inventory. This inventory will help to establish a benchmark against which to measure the success of fuel and energy efficiency projects and programs.

Unless otherwise indicated, all questions refer to a ONE-WAY commute TO WORK only. Please do not include any traveling you do during work hours (meetings, site visits, etc.).

The survey should take no more than 5 to 7 minutes.

If you have any questions, please contact *Amanda Brennan* at x2016 or brennana@rcgov.us or *Anna Lange* at x1364 or langea@rcgov.us.

Please note that this survey is completely anonymous. We will not collect or report data on any individuals who respond to the survey, unless you opt in to information about the rideshare/carpool program at the end of the survey.

Thank you for your participation.

1. **Did you work for Richland County in 2009?**

   ☐ Yes
   ☐ No

2. **Which Richland County Department do you work for?**

   _____

3. **How do you get to work each day?**

   ☐ I drive my own vehicle
   ☐ I ride with someone else
   ☐ I use public transportation
   ☐ I ride my bike
   ☐ I walk

4. **How many miles do you travel *TO WORK* each day?** _____ Miles

5. **How many days per week do you work for Richland County?** ____ Days Per Week

6. **What is the make and model of your vehicle?** (i.e. Ford F150, Honda Accord)
   Make: _____ Model: _____

7. **What model year is your vehicle?** _____ Year

8. **What type of fuel does your vehicle use?**
   - ☐ Gasoline
   - ☐ Diesel
   - ☐ Other, Please Explain

     _____
     _____

9. **If you would be interested in receiving information about a rideshare/carpool program with other Richland County employees, please provide your name, home address, and e-mail address.**

   Name: _____

   Home Address:
   _____

   E-mail Address: _____

THANK YOU!

Please return the completed survey to your department head or directly to Amanda Brennan in Administration.

Thank you very much for taking the time to complete the Employee Commute Survey. We greatly appreciate your participation!

Appendix D: EECBG Funded Projects

Richland County received the EECBG stimulus grant in November 2009 in the amount of $2,116,800. The grant will end in November 2012.

The following projects will be completed:

- Hired a Sustainability Coordinator for the duration of the grant period
- Electric vehicle purchased for the Town of Eastover
- 2,044 feet of sidewalk installed in Irmo, off of Charring Cross Lane
- Converted Forest Acres holiday light display to LED lighting
- Installed a 200 gallon hot water heater in the Judicial Center to replace 5,440 gallon boiler for parts of the year
- Helped purchase hybrid vehicle for the Town of Blythewood
- Installed a 800 ton chiller in the Alvin S. Glenn Detention Center to replace aging units
- Installed 4 virtual servers to replace 22 physical servers at the Administration Complex
- Developed a recording system for Register of Deeds that in the project's first year processed almost 3,000 packages saving staff time and wear and tear on equipment and increasing options for customers
- Funded and installed a solar thermal array and stack economizer at Palmetto Health Richland
- Hired a Recycling Coordinator for the Town of Blythewood to expand recycling efforts
- Purchased 8 hybrid vehicles for Richland County's fleet
- Held an annual Lawn Mower Exchange for residents to trade in gas-powered lawn mowers for electric ones, resulting in almost 600 exchanges between 2007 and 2012
- Implemented a Light Bulb Exchange Program which created partnerships with over 20 organizations and allowed Richland County residents to exchange over 13,000 incandescent bulbs for compact fluorescent bulbs
- Installed energy efficient lighting and motion sensors in the Administration Complex and part of the Judicial Center
- Developed a Regional Sustainability Plan in partnership with Lexington County and the City of Columbia (in kind) to establish goals and guidelines to reduce energy and water use, and promote smart growth and the green economy

Appendix E: Richland County Baseline Emissions Inventory Contacts

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