

MULTI-MUNICIPAL GREENHOUSE GAS EMISSIONS INVENTORY & CLIMATE CHANGE ACTION PLAN

VOLUME 1: GHG EMISSIONS INVENTORY

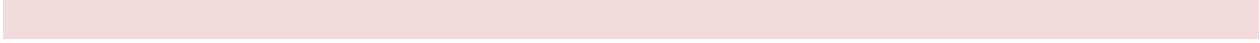
January
2011

A Report Prepared for:

Falls, Lower Makefield, Lower Southampton and Middletown
Townships and **Pennel** Borough (Bucks County, Pennsylvania)

by the

Center for Sustainable Communities, Temple University, Ambler PA



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Volume I: Greenhouse Gas Emissions Inventory (Base Years 2005 / 2006)

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Table of Contents

List of Figures.....	i
List of Tables.....	i
Executive Summary.....	iii
Introduction.....	1
Project Background.....	1
Environmental and Energy Challenges.....	3
Project Approach.....	4
Community Greenhouse Gas Inventory.....	6
Government Greenhouse Gas Inventory.....	12
Scopes of Emissions.....	15
Cost.....	16
Emissions Projections.....	18
Acknowledgments.....	20
Works Cited.....	20
Appendix:.....	22

List of Figures

Figure 1: The Five Communities Participating in the Project.....	2
Figure 2: Total Greenhouse Gas Emissions, 2005.....	6
Figure 3: Per Capita GHG Emissions (in MTCO ₂ E), 2005.....	8
Figure 4: Community Emissions by Sector (MTCO ₂ E; DVRPC, 2005).....	9
Figure 5: Per Capita Emissions, Residential Sector Only (in MTCO ₂ E), 2005.....	10
Figure 6: Community GHG Emissions by Source, 2005.....	10
Figure 7: Per Capita (Residents) Emissions from Government Operations (in MTCO ₂ E), 2006.....	12
Figure 8: Government Emissions by Sector (in MTCO ₂ E), 2006.....	14
Figure 9: Government Emissions by Source, 2006.....	15

List of Tables

Table 1: The Project Municipalities at a Glance (DVRPC, 2005).....	7
Table 2: Total Municipal Government Emissions (in MTCO ₂ E), 2006.....	12
Table 3: Scopes of Government Emissions (2006).....	16
Table 4: Municipal Government Costs per Sector, 2006.....	17
Table 5: Total and Per Capita GHG Emissions, Actual and Projected, 2005-2035.....	18
Table 6: Community Emissions by Sector, Individual and all Municipalities Combined (MTCO ₂ E, 2005).....	22
Table 7: Percent of Community Emissions by Sector (2005).....	22
Table 8: Community Emissions by Source, Individual and all Municipalities Combined (MTCO ₂ E, 2005).....	23
Table 9: Percent of Community Emissions by Source (2005).....	23

Table 10: Government Emissions by Sector, Individual and Municipalities Combined (MTCO₂E, 2006) 24

Table 11: Percent of Government Emissions by Sector (2006) 24

Table 12: Government Emissions by Source, Individual and Municipalities Combined (MTCO₂E, 2006)..... 25

Table 13: Percent of Government Emissions by Source (2006)..... 25

Table 14: Falls Township Scopes of Government Emissions 26

Table 15: Lower Makefield Township Scopes of Government Emissions..... 26

Table 16: Lower Southampton Township Scopes of Government Emissions 27

Table 17: Middletown Township Scopes of Government Emissions 27

Table 18: Pennel Borough Scopes of Government Emissions 28



This report is the first volume of the **Multi-Municipal Greenhouse Gas Emissions Inventory and Climate Action Plan** completed on behalf of the municipalities of Falls Township, Lower Makefield Township, Lower Southampton Township, Middletown Township, and Penndel Borough (Bucks County, Pennsylvania) with the technical assistance of Temple University's Center for Sustainable Communities (CSC) and the financial support of the Pennsylvania Department of Environmental Protection. The report includes analysis of Greenhouse Gas (GHG) emissions by the five municipal governments and the communities' residents and businesses. For the municipal governments, analysis was completed for the year 2006; for the communities the analysis was completed for the year 2005. These inventories — initiated by the township and borough councils with the support of the communities' Environmental Advisory Council (EACs) — set a baseline against which to measure future efforts to reduce GHG emissions.

Total GHG emissions in 2006 attributable to the residents, businesses, institutions, and municipal government operations in the five communities equaled 1,594,903 metric tons of carbon dioxide (CO₂) equivalents (MTCO₂E). The most significant emissions *sectors* in the four communities are Residential Home Energy Use (accounting for 32% of total GHG emissions) and Transportation (31%). The largest *sources* of GHG emissions are electricity (38%) and gasoline (25%).

The five municipal governments' emissions in 2006 were 9,461 MTCO₂E, 0.59% of the communities' GHG emissions. The major *sectors* of government emissions were Buildings and Facilities (29%), Streetlights and Traffic Signals (29%), and Vehicle Fleet (27%) and the two major *sources* of government emissions were electricity (53%) and gasoline (29%). Natural gas (11%) was another significant source of government emissions, while all other sources accounted for 5% or less of total emissions.

In addition to the detailed information on community and municipal government emissions, this report also provides projections for the year 2025 when emissions could be about 10% lower than they were in 2005 *if* community changes in per capita emissions reflect those forecast for the nation as a whole by the US Department of Energy's Energy Information Agency. Technical information concerning the data collection and analytical methods used are provided, as well as comparisons to emissions at the regional and national levels.

The use of the information provided in this document for planning energy consumption and GHG emissions reduction efforts will be discussed in the companion Volume 2 of this report.

~ Temple University Center for Sustainable Communities, January 2011

Introduction

This report presents the results of a Greenhouse Gas (GHG) emissions inventory that Temple University's Center for Sustainable Communities (CSC) completed on behalf of five municipalities in Bucks County, Pennsylvania – Falls Township, Lower Makefield Township, Lower Southampton Township, Middletown Township, and Pennel Borough. The inventory was initiated as part of a 2009 grant provided by the Pennsylvania Department of Environmental Protection (DEP) to the five municipalities.¹ The DEP's Local Government Greenhouse Gas Pilot Grant was designed to assist municipalities in conducting emissions inventories and developing action plans for reducing emissions in future years. Applications from municipalities already actively working to reduce energy consumption and willing to collaborate on multi-municipal inventories and action plans were especially encouraged.

This volume of the report is divided into five principal sections: 1) this introduction, 2) background information on the project participants, climate change, and the methods used to conduct the analysis, 3) a GHG emissions inventory for the five communities (residential, commercial, industrial, and transportation-related emissions), 4) a GHG emissions inventory for the municipal governments representing the five communities, and 5) projections of emissions for future years. Details for each municipality's government and community emissions are provided in the appendix of the report.

Project Background

The neighboring municipalities of Falls Township, Lower Makefield Township, Lower Southampton Township, Middletown Township, and Pennel Borough are located approximately twenty miles north of the city of Philadelphia in Bucks County, Pennsylvania (see [Figure 1](#) on following page). The region is characterized primarily by residential-single family detached housing neighborhoods, as well as some industrial and commercial properties, wooded areas, and a small amount of multi-family residential housing and agriculture. The communities' proximity to Philadelphia and other major regional destinations makes them a popular residential choice for people who desire a suburban lifestyle with good access to jobs, resources, and recreational opportunities.

Of the population 25 years and older in 2000, 90% had attained at least a high school diploma, and 34% had gone on to achieve a bachelor's degree or higher.² The average per capita income in 2000 for the five communities was \$29,228, more than \$8,000 above the state average. Nevertheless, significant diversity exists within the five communities: measured by per capita income, Lower Makefield Township was the eighth most affluent municipality in the state in 2000 with an average per capita

¹ *The project was originally managed by the consulting firm CMX. Following its bankruptcy in early 2010, Temple University's Center for Sustainable Communities was asked to complete the project.*

² *Demographic and socio-economic data for the four communities are from the 2000 US Census using the American FactFinder tool.*

income of \$56,288, while Penndel Borough was 1,160th at \$17,897. The top three industries in the area in 2000 were educational, health and social services; retail trade; and manufacturing.

Like many other communities in the Delaware Valley region, the five communities have each established Environmental Advisory Council (EACs) to provide advice and leadership on environmental issues affecting their communities.³ The five municipalities are all member communities of ICLEI – Local Governments for Sustainability, an international membership organization of more than one thousand local communities working to address climate change and environmental sustainability.⁴

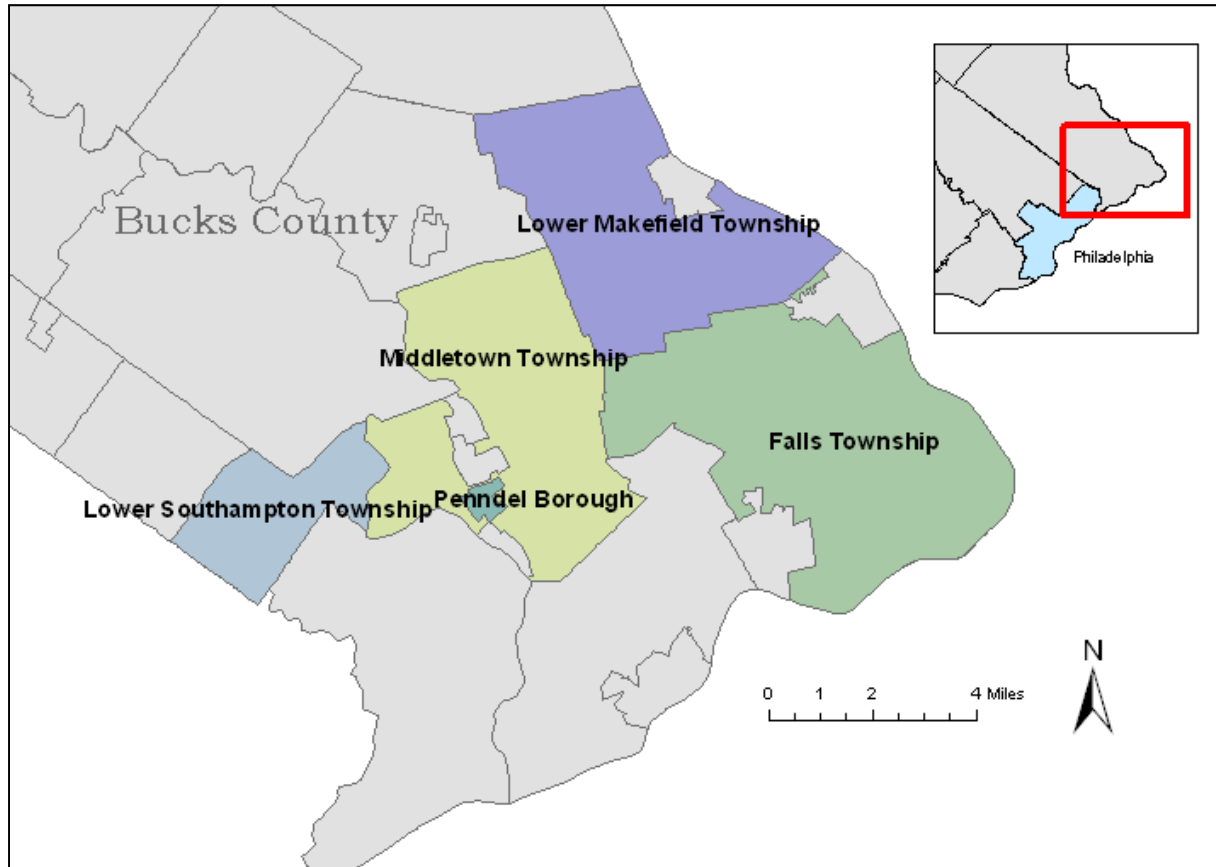


Figure 1: The Five Communities Participating in the Project

³ See the website of the Pennsylvania Environmental Council at <http://www.pecpa.org/node/86> for more information on EACs.

⁴ For more information about ICLEI—Local Governments for Sustainability, see <http://www.icleiusa.org/>.

Environmental and Energy Challenges

The results of this GHG emissions inventory are designed to help planners, elected officials, residents and business owners confront the significant challenges that climate change and growing global energy demand represent. Our modern economy is based upon the consumption of inexpensive energy for construction, communications, transportation, building operations, agriculture, industry, and commerce. Most of the energy consumed in American communities comes from non-renewable fossil fuels: petroleum refined into gasoline, diesel, jet fuel, kerosene, heating oil, and other fuels; coal; and natural gas. As fossil fuels are combusted to provide energy, gases are emitted, including carbon dioxide (CO₂) and nitrogen oxides (NO_x). These and other gases, especially methane (CH₄) and chlorofluorocarbons, are commonly referred to as “greenhouse gases” for their heat-retaining quality that contributes to global climate change.

While some uncertainty remains in the scientific community as to the severity and timing of the impacts of climate change, there is no uncertainty that concentrations of carbon dioxide in the atmosphere are rising, that global temperatures are warming, and that human activities contribute to climate change that will have serious impacts on the natural environment and national and local economies. These activities include not only the combustion of fossil fuels, but also agricultural production, the use of chemicals for building and vehicle cooling, the decomposition of solid and liquid wastes, and land use changes as forests are converted to other uses.⁵

Changing global and regional climates due to the emissions of GHGs from the use of fossil fuels for energy pose significant environmental challenges now and in coming years. These changes could have serious impacts on the economy of Pennsylvania and the quality of life for all of its residents. Some of the significant changes expected include increases in the number of summer days over 90 degrees Fahrenheit, deteriorating air quality, reductions in cows’ milk production, decreases in the yields of many crops, a shortening or cessation of winter sports seasons, and deteriorating conditions for prized hardwood trees.⁶

Reducing greenhouse gas emissions—by municipalities and other public institutions, businesses and non-profit organizations, and individuals—can be achieved through greater efficiency in the use of energy sources, including the most widely used sources, electricity, natural gas, motor fuels (gasoline and diesel), and fuel oil. Behavioral changes too can be effective in reducing GHG emissions and could include heating and cooling buildings more conservatively, using shared and non-motorized forms of transportation for local travel more frequently, and eating a diet with less meat and processed foods.

There are many reasons to use resources more sustainably and to reduce or mitigate the negative impacts of economic activities on the natural environment. More efficient use of resources

⁵Anderegg, W. R. L., Prall, J. W., Harold, J., & Schneider, S. H. (2010). *Expert Credibility in Climate Change*. Proceedings of the National Academy of Sciences, 107(27), 12107-12109.

⁶Union of Concerned Scientists. (2008). *Climate Change in Pennsylvania: Impacts and Solutions for the Keystone State*. Cambridge, MA: Union of Concerned Scientists

reduces pollution emissions into the air and water, and contributes fewer greenhouse gases to the atmosphere. Just as importantly, more sustainable use of resources can result in significant financial savings on energy, water, and waste-related costs, and contribute to greater stability and predictability in energy markets.

Accurately assessing the success of energy and GHG emissions reduction efforts requires precise measurements in a base year. This report provides the baseline needed by residents, business owners, and municipal leaders in the five project communities in order to implement effective responses to climate change.

Project Approach

This GHG Inventory was originally undertaken as a collaborative effort between the consulting firm CMX and the five project municipalities. Following the bankruptcy of CMX in early 2010, Temple University's Center for Sustainable Communities (CSC) was selected to provide technical assistance in completing the GHG inventory and report. CMX and CSC staff collected data from the municipalities and other sources in order to conduct the analyses that are documented in this report.

Data collected from the five municipalities, including building electricity, natural gas, fuel oil, street and traffic light electricity, and solid waste bills, and records of gasoline and diesel purchases, were used to estimate municipal government emissions. Employee commute estimates were determined using the results of a survey of municipal employees regarding their work commute patterns. All of the data for the community emissions inventory came from the Delaware Valley Regional Planning Commission.⁷

Analysis for the GHG emissions inventory was accomplished using standard office computer software packages such as Microsoft Excel and through the use of the Clean Air and Climate Protection (CACP) software package distributed by ICLEI. All of the communities involved in this report are members of ICLEI and have full access to the information, analytical, and training resources of the organization. Using the CACP software, and in consultation with the Delaware Valley Regional Planning Commission (DVRPC), emissions calculations were converted into a standard unit of measurement—metric tons of carbon dioxide equivalent (MTCO₂E).⁸

⁷ Delaware Valley Regional Planning Commission 2009. Additional information came from DVRPC's Data Navigator tool (<http://www.dvrpc.org/asp/mcddataNavigator/>) and communications with DVRPC staff-members Robert Graff and Elizabeth Compitello.

⁸ Because there are several important greenhouse gases that are accounted for in an inventory of this type, a conversion is made to carbon dioxide equivalents and the results are reported in metric tons (one metric ton of 1,000 kilograms is equal to 2,205 U.S. pounds). Metric tons of CO₂ equivalents are usually abbreviated as MTCO₂E.

The analysis conducted in preparing this inventory allows GHG emissions to be categorized in three ways: in terms of sectors, sources, and scopes.⁹

- **Sectors** are used to group emissions by type of end use. The sectors used in the community inventory are Residential, Commercial, Industrial, Mobile-highway, Mobile-transit, and Non-energy GHG sources.¹⁰ Municipal government emissions are categorized in six sectors: Buildings and Facilities, Streetlights and Traffic Signals, Water Delivery Facilities, Vehicle Fleet, Employee Commute, and Refrigerants.
- **Sources** describe the type of fuel, energy source or material which produced the emissions. The sources of emissions cited in this report include those fuels that are primarily combusted in furnaces or vehicles (gasoline, diesel, fuel oil, natural gas, liquid petroleum gas [LPG], and propane), as well as electricity,¹¹ methane and nitrogen oxides from wastewater treatment, solid waste, “fugitive” emissions of methane in natural gas transmission and sulfur hexafluoride in electricity transmission, and other sources such as Chlorofluorocarbons (CFCs) used as refrigerants.
- **Scopes** are used to identify three different levels of control and responsibility that community residents, business owners, and municipal governments have over the quantities of GHGs emitted by the five project communities.
 - Scope one emissions are those that are under the direct control of the user and originate at the site where fuels are used, such as during the combustion of natural gas and heating oil in home or business furnaces.
 - Scope two emissions are from the use of electricity; users control the quantity of electricity used, but not the sources or carbon content of the fuel or fuels (coal, nuclear, natural gas, etc.) a utility uses to generate the electricity.
 - Finally, scope three emissions come from sources that the community or municipal government does not have direct control over, but for which they have indirect responsibility. An example of this in the government inventory is the motor fuel used by employees to commute to work.

⁹ Another important way to categorize the sources of emissions is as stationary or mobile sources. Stationary emissions are those associated with energy use at a specific location, while mobile emissions are related to motor fuels used in cars, trucks, and other vehicles.

¹⁰ “Non-energy greenhouse gas sources” consist of agriculture emissions, landfill emissions, wastewater treatment, industrial processes, and fugitive emissions from natural gas systems, as well as land-use, land-use change, and forestry (LULUCF).

¹¹ Electricity is not directly a source of GHG emissions—turning on a lamp, for example, does not generate emissions at the source of use. But electricity is considered a source category because the combustion or use of fuels to generate electricity (such as coal, natural gas, or nuclear) result in GHG emissions. The average CO₂E emissions per kWh of electricity use can be calculated and reported in a GHG emissions inventory, as is done here.

Community Greenhouse Gas Inventory

This section of the GHG emissions inventory presents the total greenhouse gases emitted within the boundaries of each municipality, including those attributable to government facilities and operations. The year 2005 was used as the baseline for the community section of this inventory. The same year served as the baseline in the Delaware Valley Regional Planning Commission's recent *Regional Greenhouse Gas Emissions Inventory* report (DVRPC, 2009) on which the findings for this section were based. In that year, the total greenhouse gas emissions for the five municipalities was 1,594,903 MTCO₂E. This number is further broken down throughout this section in order to show the total and per-capita emissions for each municipality, the emissions for each municipality by sector, the residential only emissions, and the emissions for each municipality by source. By looking at emissions from a number of different perspectives the communities will be better prepared to set goals and make reductions.

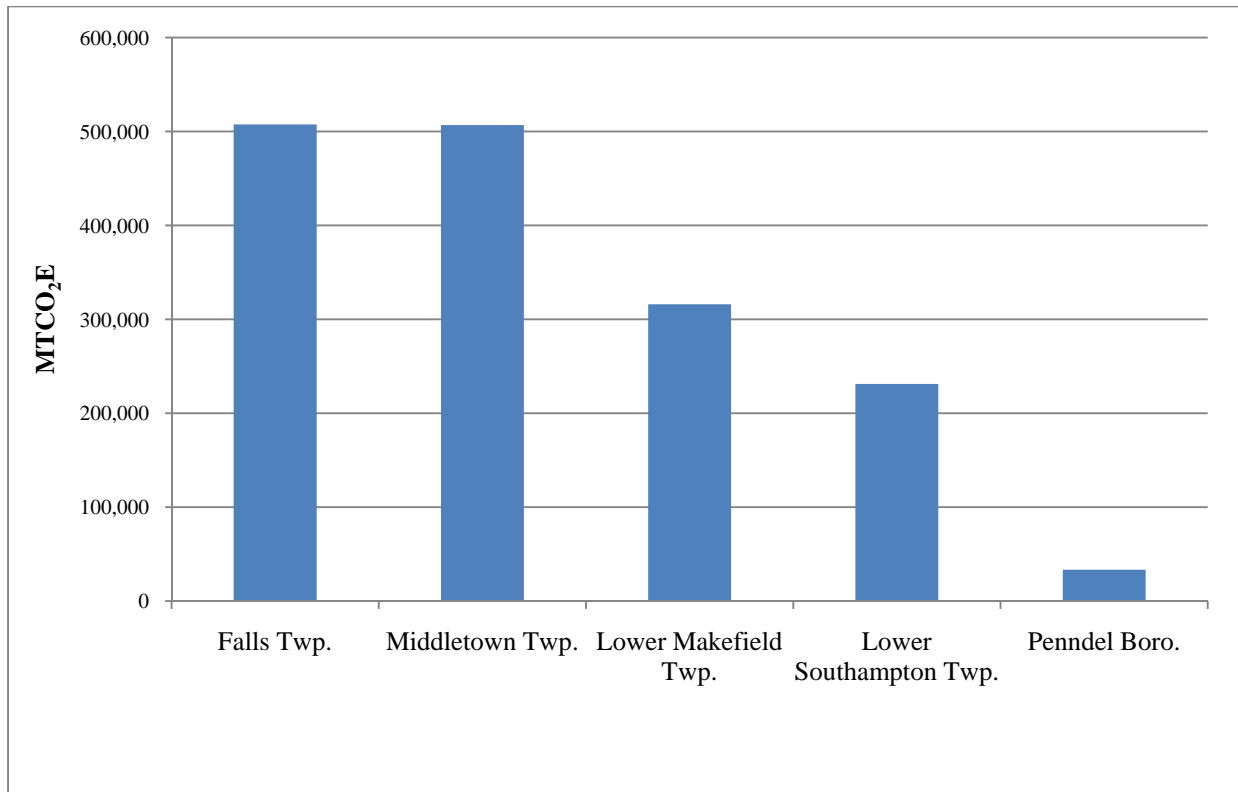


Figure 2: Total Greenhouse Gas Emissions, 2005

The community inventory is broken down into the following sectors: *Residential*, *Commercial*, *Industrial*, *Mobile-highway*, *Mobile-transit*, and *Non-energy* greenhouse gases. The Residential, Commercial, and Industrial sectors reflect traditional definitions of those terms. The Mobile-highway sector accounts for all vehicular traffic in the communities, except for through traffic and public transit sources. The Mobile-transit sector accounts for the operation (within community boundaries) of all public transit vehicles, such as buses and trains. Non-energy greenhouse gas sources consist of

agriculture emissions, landfill emissions, wastewater treatment, industrial processes, and fugitive emissions from natural gas systems (natural gas losses in the form of methane that occur during transmission). This last sector also includes considerations of land-use, land-use change, and forestry (LULUCF) within the community. The presence of forested, wooded or pastured land may result in emissions credits being given back to the community based on the carbon sequestering properties of trees and other vegetation.

In **Figure 2** (preceding page) the total GHG emissions is shown for each municipality with the large differences reflecting, among other things, the significant differences in residential population and employment in the five communities (see **Table 1** below).

	Population	Households	Employment
Falls Township	34,273	13,032	15,973
Lower Makefield Township	32,719	11,833	5,474
Lower Southampton Township	19,345	7,226	11,267
Middletown Township	47,564	16,624	22,697
Penndel Borough	2,398	908	1,098
Total for the five communities	<u>136,299</u>	<u>49,623</u>	<u>56,509</u>

Table 1: The Project Municipalities at a Glance (DVRPC, 2005)

A more complete understanding of the GHG emissions for the five communities is presented by looking at per capita emissions for each (**Figure 3**). Per person, Falls Township (with the second highest population) was the largest contributor of GHG emissions, while Penndel Borough (with the smallest total population) is the second largest contributor of GHG emissions. Many factors contribute to a community’s per capita emissions, with income generally having a strong association with emissions. Falls Township has both the highest per capita income of the five communities (\$43,983 vs. an average of \$29,228)¹² and the highest per capita emissions. In addition, its Industrial sector is large, accounting for additional per capita emissions. Overall, the per capita emission for each of the five municipalities fell well below the national and regional averages for greenhouse gas emissions per capita in 2005 (20.3 and 16.5 MTCO₂E, respectively).^{13, 14}

¹² US Census Bureau, 2000.

¹³ Per capita carbon dioxide emissions from the consumption of energy: <http://tonto.eia.doe.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=45&aid=8&cid=&syid=2004&eyid=2008&unit=MMTCD>.

¹⁴ DVRPC. (2009). Regional Greenhouse Gas Emissions Inventory. Pg. 8.

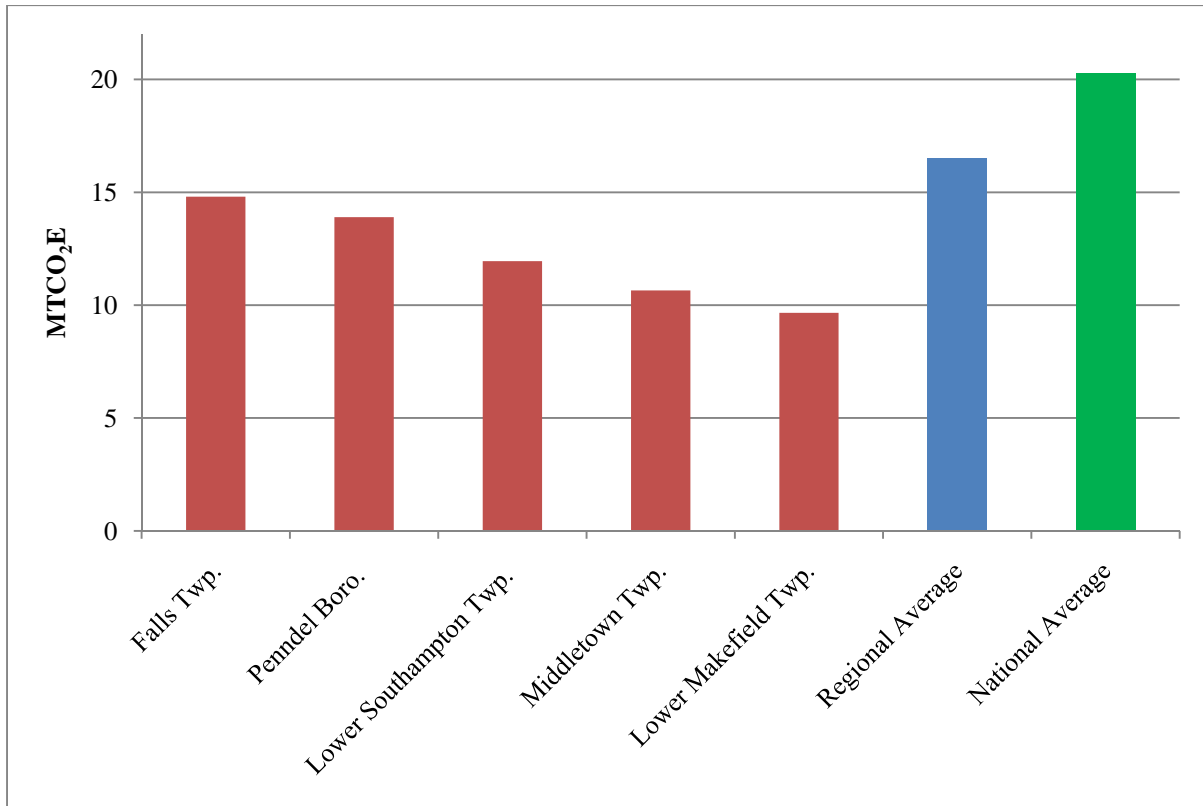


Figure 3: Per Capita GHG Emissions (in MTCO₂E), 2005

In addition to comparing the emissions of the municipalities relative to one another, it is important to look at the sources of emissions within each community. One way to do this is by considering total GHG emissions for each community by sector (see [Figure 4](#) on the following page) and noting the patterns that are evident. In four of the five communities the Residential, Commercial, and Mobile-highway sectors were the largest sources of GHG emissions, with Falls Township being the exception where the Industrial sector (27.4% of GHG emissions) was larger than any other sector. Pennel Borough too had a relatively large share of emissions from the Industrial sector (16.6%); in the remaining three communities the Industrial sector was less than 6% of emissions. Non-energy greenhouse gas emissions were between 5% and 8% of the total emissions for all of the communities, while the Mobile-transit sector contributed the smallest amount of emissions (less than 1%). More detailed tables for the breakdown of emissions numbers for each community by sector can be found in the appendix of this report.

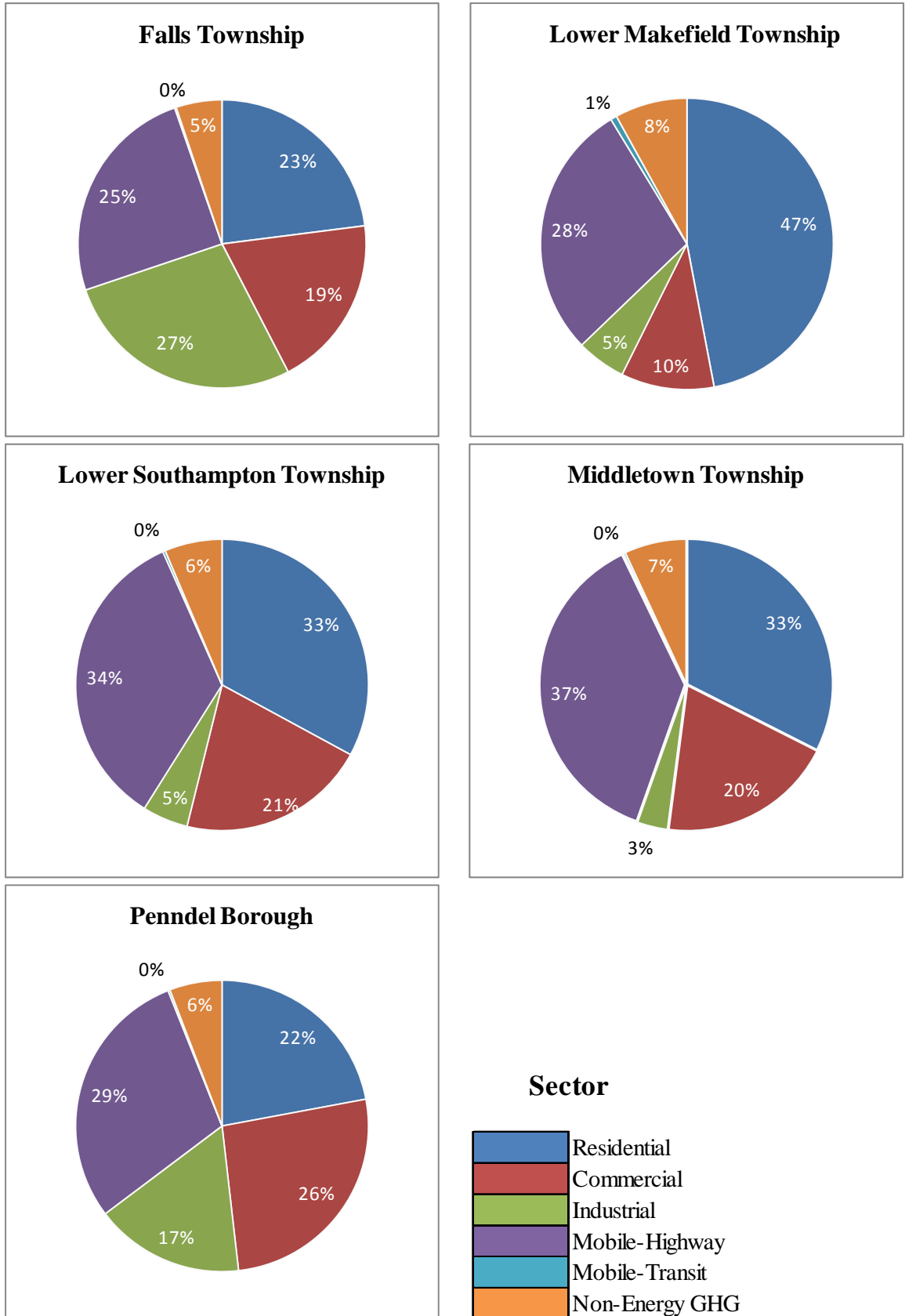


Figure 4: Community Emissions by Sector (MTCO₂E; DVRPC, 2005)

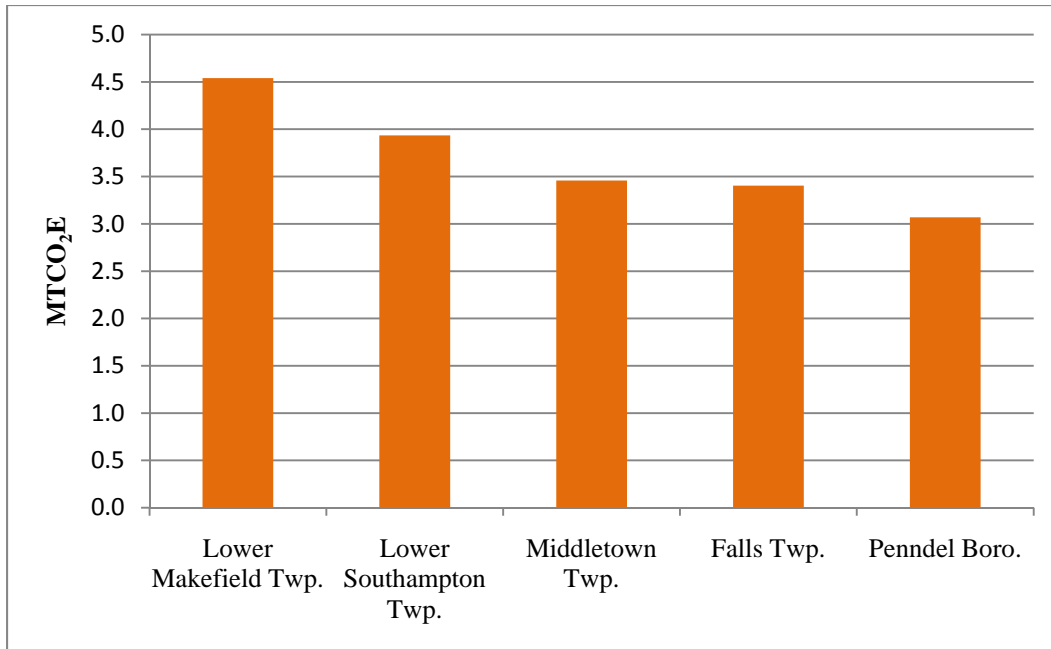


Figure 5: Per Capita Emissions, Residential Sector Only (in MTCO₂E), 2005

Because there are large differences in industrial and commercial activity within the five communities, it is useful for residents to consider how GHG emissions differ for the residential (household) sector alone (Figure 5). The two municipalities with the highest per-capita emissions overall, Falls Township and Penn-del Borough, had the lowest residential sector emissions of the five communities. Conversely, Lower Makefield Township, which had the lowest per capita emissions overall, had the highest residential per capita emissions in 2005. Differences in per capita income reflect the order of residential sector per capita GHG emissions, with the wealthier of the five communities having higher levels of emissions.

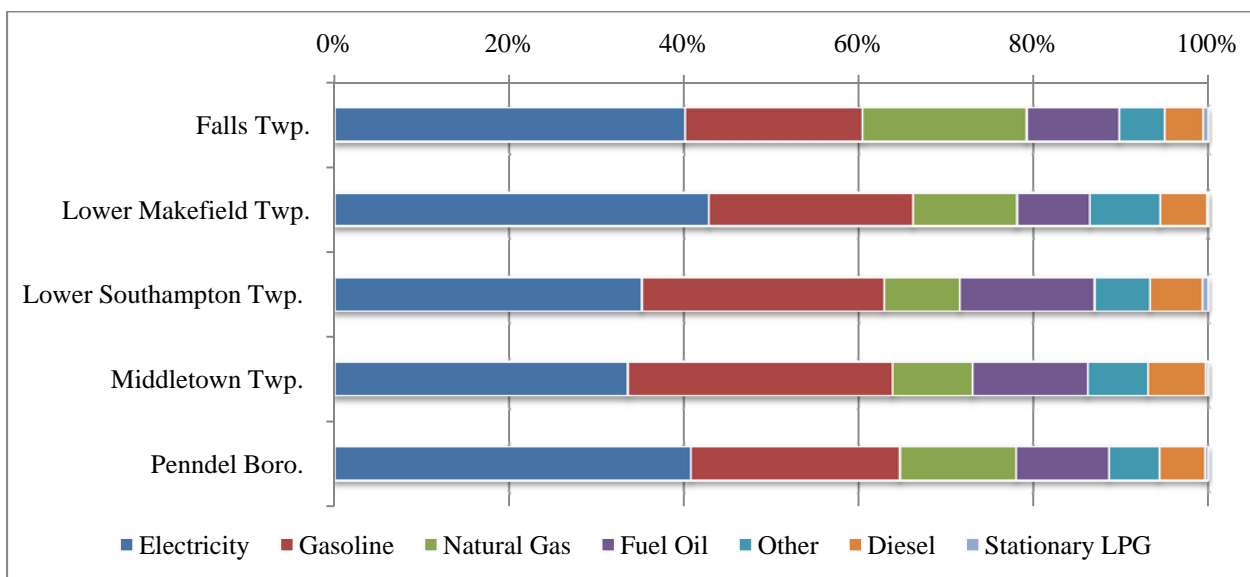


Figure 6: Community GHG Emissions by Source, 2005

Another important way to consider emissions within each municipality is by the source (**Figure 6**). From this perspective, the municipalities were very similar, one to another. Electricity was clearly the largest source of emissions in every community and gasoline was the second largest source. The third largest source of GHG emissions for all communities was either natural gas or fuel oil. Diesel fuel and other emissions sources¹⁵ were the fifth and sixth largest contributor in each municipality, while stationary LPG (liquid petroleum gas – used for heating) accounted for less than 1% of emissions in each of the communities.

¹⁵ This category includes the non-energy greenhouse gas sources consisting of agriculture emissions, landfill emissions, wastewater treatment, industrial processes, and fugitive methane emissions from natural gas systems, minus emissions credits from LULUCF.

Government Greenhouse Gas Inventory

Municipal governments, their staffs, buildings, and vehicles all rely on energy sources that produce greenhouse gases in order to function. The total greenhouse gas emissions for the five Bucks County municipal governments involved in the study were 9,455 MTCO₂E, 0.6% of the 1.6 million MTCO₂E of community-wide GHG emissions. The baseline year used for the government section of this greenhouse gas inventory was 2006.¹⁶

Municipality	Total Emissions (MTCO ₂ E)
Falls Township	2,298
Lower Makefield Township	2,510
Lower Southampton Township	1,554
Middletown Township	2,938
Penndel Borough	155
Total for the five communities	<u>9,455</u>

Table 2: Total Municipal Government Emissions (in MTCO₂E), 2006

Table 2 shows the total emissions for each municipal government. In general, the levels of municipal government emissions reflect the differences in population amongst the five communities. As with the community emissions section, per capita emissions of government operations are calculated (**Figure 7**, next page). There are only small differences, with between .06 and .08 MTCO₂E per resident in the five communities.

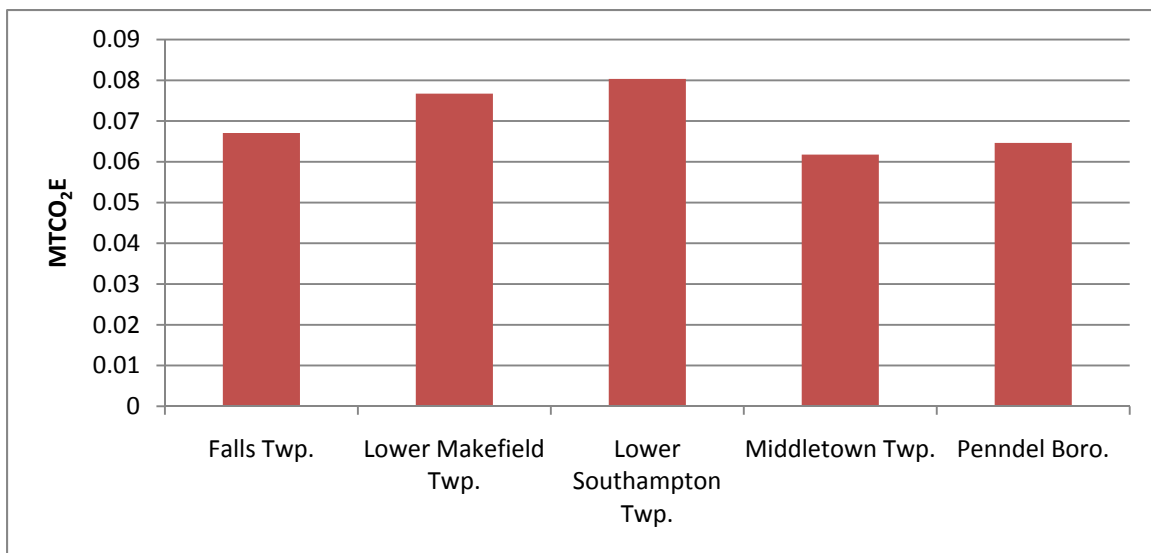


Figure 7: Per Capita (Residents) Emissions from Government Operations (in MTCO₂E), 2006

¹⁶ The year 2006 was the baseline year requested in the Department of Environmental Protection's grant proposal.

Municipal government emissions typically come from buildings operation, the electricity required to illuminate streetlights and traffic signals and power water delivery facilities, fuel for vehicle fleets, and the emissions created by employees' work commutes. In the five Bucks County communities which took part in this inventory, these emissions sectors accounted for the activities of police, public works, parks and recreation, and administrative functions. The school districts in the five communities are independent of the municipal governments and were not considered in this section of the inventory (they are accounted for in the total community emissions). All of the governments had water delivery facilities (pump and lift stations) in 2006 and one municipality, Falls Township, owned a wastewater treatment facility at the time, which has since become independent of the township government. Other public functions which, in some communities, are considered municipal government operations include fire departments, libraries, public pools, rescue squads, and stray dog facilities. For more information on this topic see the sidebar entitled, "Municipal government GHG inventories and operational control."

Looking at the government GHG emissions by sector ([Figure 8](#), next page) reveals a larger discrepancy from municipality to municipality than it did in the community sections, where the breakdown was more uniform. Emissions for the Buildings and Facilities sector ranged from 46% in Lower Makefield down to a mere 8% in Middletown. Similarly, the Streetlights and Traffic Signals sector ranged from 10% in Lower Makefield Township to 38% in Falls Township. Water Delivery Facilities accounted for 20% of Penndel Borough's total government emissions but only 1% of Middletown Township's government emissions. The Vehicle Fleet sector was relatively more uniform from municipality to municipality, ranging from 34% in Falls to 20% in Penndel Borough. Employee commute was usually the smallest contributor to emissions, with one exception, Penndel Borough, where it accounted for more emissions than the buildings and facilities sector. Because of the high degree of differences between the municipal governments in GHG emissions by sector it will be important that each municipal government tailor reductions strategies to their individual situations.

Municipal government GHG inventories and operational control

Government operations in Pennsylvania are often fragmented, making the definition of what constitutes a *municipal government operation* confusing. Fire companies can be particularly difficult to categorize, with the issue being the level of direct control over operations that the municipal government can exercise. The *Local Government Operations Protocol, Version 1.1* (see California Air Resources Board, et al. 2010) recommends considering an organization a municipal government operation if the municipal government wholly owns the operation, facility or source or it has "the full authority to introduce and implement operational and health, safety and environmental policies..." or both. None of the fire companies operating within the boundaries of the five municipalities involved in this study meets these criteria and, so, they were not included in this analysis as government facilities.

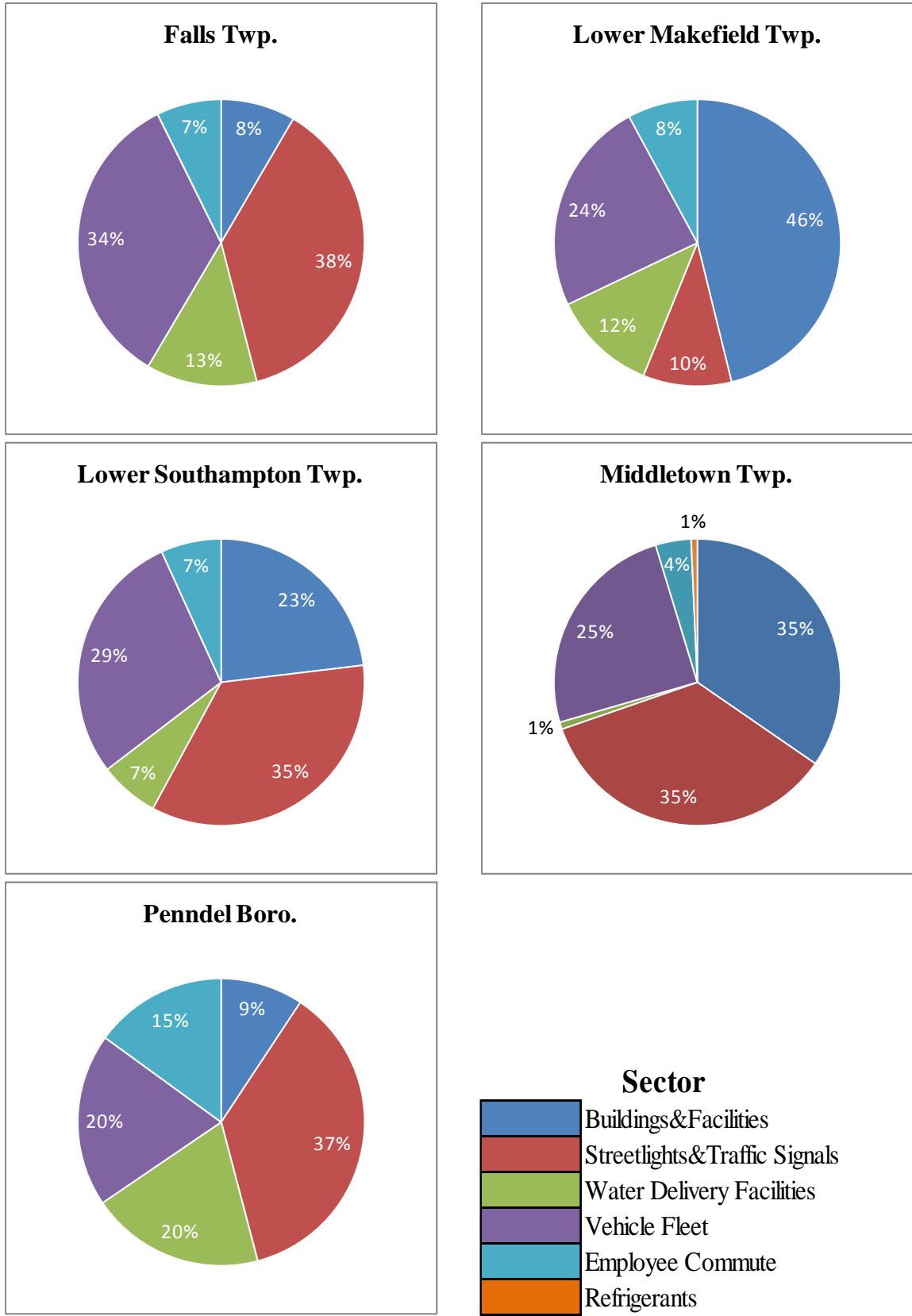


Figure 8: Government Emissions by Sector (in MTCO₂E), 2006

Electricity was the largest source of emissions for each of the five municipal governments (Figure 9). Gasoline was the second largest contributing source in all of the municipal governments but one, Lower Makefield Township, where natural gas was the second largest source and gasoline was third. Natural gas was the third largest source of emissions in Lower Southampton Township, Middletown Township, and Penn-del Borough. In Falls Township natural gas and diesel represented the same, relatively small, percentage of emissions.

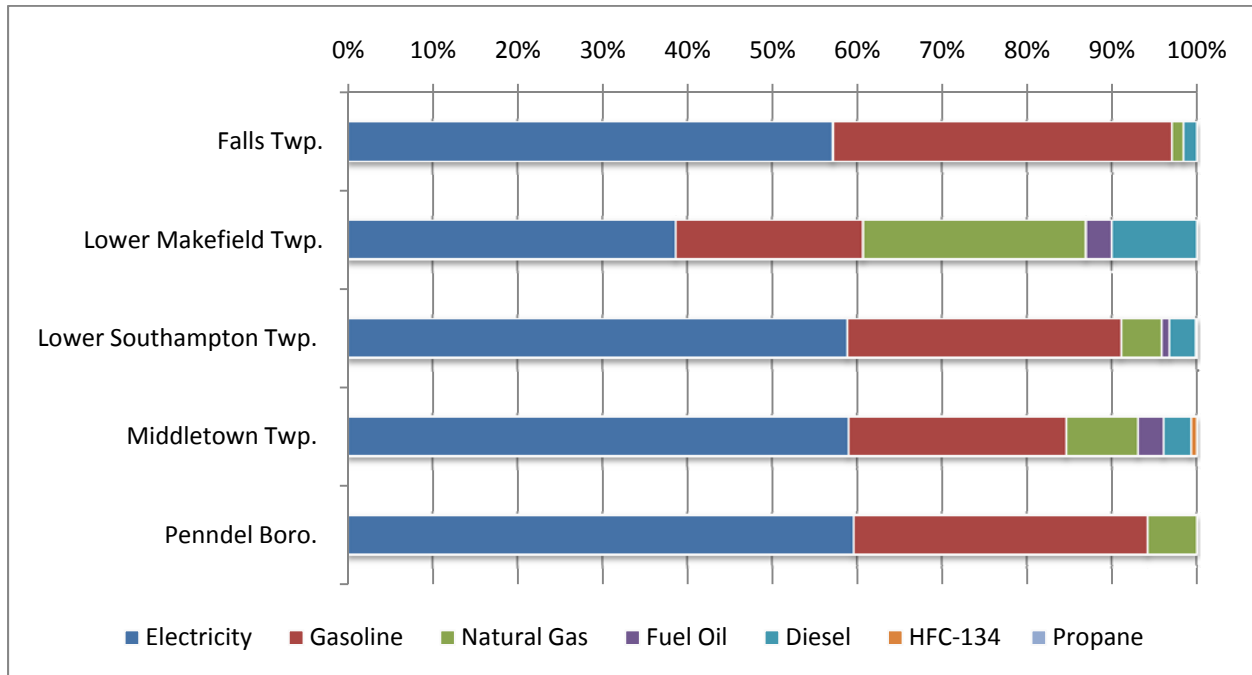


Figure 9: Government Emissions by Source, 2006

Fuel oil was a source of emissions in three of the municipal governments, Lower Makefield, Lower Southampton, and Middletown Townships, and was a relatively small source in all three. Penn-del Borough had just three total sources of emissions: electricity, gasoline, and natural gas. HFC-134 (a refrigerant commonly referred to as “Freon”) was a source of emissions only in Middletown Township and propane was a source only in Lower Southampton Township.

Scopes of Emissions

The emissions detailed above all are the result of local governments’ operations, but the level of control that municipal governments have over the quantities of greenhouse gases emitted varies. For example, governments control the quantities of natural gas combusted to heat municipal buildings and, consequently, the tons of GHG emissions, but they have much less control over their employees’ commuting patterns and the resulting GHG emissions attributable to them. In order to understand these differences, this section assesses greenhouse gas emissions in three categories designated *scopes* in order to help understand the level of responsibility municipal governments have over GHG emissions.

The concept of scopes and the definitions of each level used here are from the *Local Government Operations Protocol*.¹⁷

Scope One emissions are those where municipal governments control both the quantity and the type of fuels used. In the five project communities, Scope One emissions are attributable to natural gas and fuel oils used in municipal buildings and motor fuels used for the operation of police, public works, and other vehicles.

Scope Two emissions are those that a municipal government controls in terms of the quantities used, but not the sources. The five municipal governments determine the amount of electricity used for municipal operations, for example, but do not control the sources of fuel used in generating the electricity that PECO provides. Scope One and Two emissions should be the first places to look for greenhouse gas emission reductions, since these are under the direct control of the local governments.

Scope Three emissions come from sources that the municipal government does not have direct control over, but for which it has indirect responsibility. In 2006 Scope Three emissions came primarily from motor fuel used by the municipal employees for their commutes to work.

	Falls Township	Lower Makefield Township	Lower Southampton Township	Middletown Township	Penndel Borough	Totals	%
Scope 1	817	1,341	533	1,086	39	3,816	40.4%
Scope 2	1,314	969	914	1,724	93	5,014	53.1%
Scope 3	168	197	105	118	23	611	6.5%

Table 3: Scopes of Government Emissions (2006)

The total amount of emissions by scope and municipality, in MTCO₂E and in percentages, are noted in **Table 3** above. More detailed information on the scopes for each community can be found in the appendix of this report.

Cost

On the next page **Table 4** details the municipal government’s expenditures in four of the five sectors of municipal government emissions; employee commute was excluded because the municipal governments incurred no expense for their employee’s commutes to and from work each day.

¹⁷ The *Local Government Operations Protocol* for the quantification and reporting of greenhouse gas emissions inventories was developed by the California Air Resources Board, California Climate Action Registry, ICLEI – Local Governments for Sustainability and the Climate Registry (see <http://www.theclimateregistry.org/downloads/2010/05/2010-05-06-LGO-1.1.pdf>).

	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Vehicle Fleet	Total
Falls Twp.	\$49,546	\$316,571	\$80,151	\$123,233	\$569,501
Lower Makefield Twp.	\$195,533	\$62,566	\$73,784	\$170,635	\$502,518
Lower Southampton Twp.	\$105,551	\$182,445	\$31,559	n/a	\$319,555
Middletown Twp.	\$253,213	\$390,045	\$5,402	n/a	\$648,660
Penn del Boro.	\$6,715	\$16,703	n/a	\$7,621	\$31,039

Table 4: Municipal Government Costs per Sector, 2006

In some of the municipalities the cost information for certain sectors was not available for 2006, the baseline year. The total costs for the municipalities in these four categories reflected each municipality's ranking in terms of population.

Emissions Projections

The Energy Information Agency of the Department of Energy forecasts a 2.25% drop in total metric tons of CO₂ equivalent emissions in the United States between 2007 and 2020, decreasing from 5,986 million MTCO₂E in 2007 to 5,851 million MTCO₂E in 2020. Because population is expected to increase 13.3% over that time from 302 million to 343 million, this analysis forecasts a reduction in per capita emissions of 13.7% from 19.8 MTCO₂E in 2007 to 17.1 MTCO₂E in 2020.

These reductions are expected to come in the form of more efficient use of energy due to rising energy prices and the implementation of stricter energy efficiency standards set for home appliances, new building construction, cars and light duty trucks, and other products. Reinforcing the reductions in energy consumption will be the decreasing carbon intensity of energy used in residences, businesses, factories, and other buildings, as renewable sources of energy—wind, solar, tidal, and other sources—and nuclear power make up greater shares of electricity generation.

Greenhouse Gas Emissions Projections, 2010-2035 (2005 base year)							
	2005 (Actual)	2010	2015	2020	2025	2030	2035
Per capita emissions (USA) in MTCO ₂ E ¹⁸	20.1	17.7	17.5	17.1	16.8	16.5	16.2
Forecast emissions reduction (2005 base)	N/A	-11.85%	-12.80%	-15.09%	-16.61%	-18.06%	-19.58%
Population, five communities ¹⁹	136,300	139,307	142,150	144,840	147,373	149,764	151,968
Per capita emissions, in MTCO ₂ E	11.7	10.3	10.2	9.9	9.8	9.6	9.4
Total emissions, five communities	1,594,903	1,436,889	1,450,415	1,439,154	1,437,994	1,435,955	1,430,002
% change in total community emissions (2005 base)	N/A	-9.91%	-9.06%	-9.77%	-9.84%	-9.97%	-10.34%

Table 5: Total and Per Capita GHG Emissions, Actual and Projected, 2005-2035

The five communities of Falls Township, Lower Makefield Township, Lower Southampton Township, Middletown Township, and Pennel Borough are forecast to have a population increase of

¹⁸ US Department of Energy's Energy Information Agency Annual Energy Outlook reports for 2008 and 2010, accessed at <http://www.eia.doe.gov/oiaf/forecasting.html>.

¹⁹ DVRPC Data Navigator, accessed at <http://www.dvrpc.org/asp/mcddataNavigator/>.

6.8%, from an estimated 136,300 in 2005 to a forecast population of 147,373 in 2025. If the 2005 per capita emissions for the five communities change at the same rate forecast for the United States as a whole, total GHG emissions will decrease from 1,594,903 MTCO₂E in 2005 to 1,437,994 MTCO₂E in 2025, a 9.84% drop in total emissions.

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Wesley	Plaisted	Falls Township EAC
Nevin	Rovenolt	Falls Township EAC
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Terry	Fedorchak	Lower Makefield Township
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John	Ackler	Lower Makefield Township EAC
Jim	Bray	Lower Makefield Township EAC
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Ted	Taylor	Lower Southampton Township
Nick	Bordner	Lower Southampton Township EAC
Dean	Bryson	Lower Southampton Township EAC
Jim	Kates	Lower Southampton Township EAC
Jeff	Kochanawicz	Lower Southampton Township EAC
Bruce	Offner	Lower Southampton Township EAC
Lisa	Berkis	Middletown Township
Ray	Chapman	Middletown Township
Debby	Lamanna	Middletown Township
Jim	McGuire	Middletown Township
Jim	Peet	Middletown Township
Colleen	Perilli	Middletown Township
Raymond	Stepnoski	Middletown Township
Erich	Wendel	Middletown Township
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Our apologies for any inadvertent omissions.

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Appendix:

	Residential	Commercial	Industrial	Mobile-Highway	Mobile Transit	Non-Energy GHG	Total
Falls Twp.	116,647	98,565	139,162	126,058	932	26,163	507,527
Lower Makefield Twp.	148,562	32,689	17,295	89,895	2,200	25,389	316,030
Lower Southampton Twp.	76,110	48,456	11,727	79,532	620	14,767	231,213
Middletown Twp.	164,445	99,414	17,058	189,561	1,169	35,145	506,791
Penndel Boro.	7,360	8,705	5,520	9,743	73	1,941	33,342
Combined	513,124	287,829	190,762	494,789	4,994	103,405	1,594,903

Table 6: Community Emissions by Sector, Individual and all Municipalities Combined (MTCO₂E, 2005)

Sector	Residential	Commercial	Industrial	Mobile-Highway	Mobile-Transit	Non-Energy GHG
Falls Twp.	23.0%	19.4%	27.4%	24.8%	0.2%	5.2%
Lower Makefield Twp.	47.0%	10.3%	5.5%	28.4%	0.7%	8.0%
Lower Southampton Twp.	32.9%	21.0%	5.1%	34.4%	0.3%	6.4%
Middletown Twp.	32.4%	19.6%	3.4%	37.4%	0.2%	6.9%
Penndel Borough	22.1%	26.1%	16.6%	29.2%	0.2%	5.8%
% of Total Emissions	32.2%	18.0%	12.0%	31.0%	0.3%	6.5%

Table 7: Percent of Community Emissions by Sector (2005)

	Electricity	Gasoline	Natural Gas	Fuel Oil	Diesel	Other	Stationary LPG
Falls Twp.	203,200	102,944	95,408	53,674	22,336	26,163	2,824
Lower Makefield Twp.	133,853	73,151	37,367	26,001	16,611	25,389	600
Lower Southampton Twp.	82,119	64,718	20,188	36,031	14,107	14,768	1,709
Middletown Twp.	171,401	154,253	46,683	67,298	33,485	35,145	1,360
Penndel Boro.	13,548	7,928	4,424	3,514	1,727	1,941	134
Combined	604,121	402,994	204,070	186,518	88,266	103,406	6,627

Table 8: Community Emissions by Source, Individual and all Municipalities Combined (MTCO₂E, 2005)

	Electricity	Gasoline	Natural Gas	Fuel Oil	Diesel	Other	Stationary LPG
Falls Twp.	40.1%	20.3%	18.8%	10.6%	4.4%	5.2%	0.6%
Lower Makefield Twp.	42.8%	23.4%	11.9%	8.3%	5.3%	8.1%	0.2%
Lower Southampton Twp.	35.1%	27.7%	8.6%	15.4%	6.0%	6.3%	0.7%
Middletown Twp.	33.6%	30.3%	9.2%	13.2%	6.6%	6.9%	0.3%
Penndel Boro.	40.8%	23.9%	13.3%	10.6%	5.2%	5.8%	0.4%

Table 9: Percent of Community Emissions by Source (2005)

	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Vehicle Fleet	Employee Commute	Refrigerants	Total
Falls Twp.	192	865	287	786	168	-	2,298
Lower Makefield Twp.	1,160	250	295	607	197	-	2,510
Lower Southampton Twp.	359	541	104	444	105	-	1,554
Middletown Twp.	1,013	1,034	23	730	118	20	2,938
Penndel Boro.	14	57	30	30	23	-	155
Combined	2,738	2,747	739	2,597	611	20	9,455

Table 10: Government Emissions by Sector, Individual and Municipalities Combined (MTCO₂E, 2006)

	Buildings & Facilities	Streetlights & Traffic Signals	Water Delivery Facilities	Vehicle Fleet	Employee Commute	Refrigerants
Falls Twp.	8%	38%	13%	34%	7%	-
Lower Makefield Twp.	46%	10%	12%	24%	8%	-
Lower Southampton Twp.	23%	35%	7%	29%	7%	-
Middletown Twp.	35%	35%	1%	25%	4%	1%
Penndel Boro.	9%	37%	20%	20%	15%	-
% of Total Emissions	29.0%	29.0%	7.8%	27.5%	6.5%	0.2%

Table 11: Percent of Government Emissions by Sector (2006)

	Electricity	Gasoline	Natural Gas	Fuel Oil	Diesel	HFC-134	Propane
Falls Twp.	1,313	918	31	-	36	-	-
Lower Makefield Twp.	969	554	659	77	251	-	-
Lower Southampton Twp.	914	501	74	14	48	-	2
Middletown Twp.	1,734	753	248	89	95	20	-
Penndel Boro.	93	54	9	-	-	-	-
Combined	5,023	2,780	1,021	180	430	20	2

Table 12: Government Emissions by Source, Individual and Municipalities Combined (MTCO₂E, 2006)

	Electricity	Gasoline	Natural Gas	Fuel Oil	Diesel	HFC-134	Propane
Falls Twp.	57.1%	39.9%	1.3%	-	1.6%	-	-
Lower Makefield Twp.	38.6%	22.1%	26.3%	3.1%	10.0%	-	-
Lower Southampton Twp.	58.9%	32.3%	4.8%	0.9%	3.1%	-	0.1%
Middletown Twp.	59.0%	25.6%	8.4%	3.0%	3.2%	0.7%	-
Penndel Boro.	59.6%	34.6%	5.8%	-	-	-	0.0%

Table 13: Percent of Government Emissions by Source (2006)

Falls Township	MTCO2E	%
Scope 1		
Buildings & Facilities Natural Gas	31	1.3%
Vehicle Fleet Fuels	786	34.2%
Scope 2		
Buildings & Facilities Electricity	162	7.0%
Streetlights & Traffic Signals Electricity	865	37.6%
Water Delivery Facilities Electricity	287	12.5%
Scope 3		
Employee Commute	168	7.3%

Table 14: Falls Township Scopes of Government Emissions

Lower Makefield Township	MTCO2E	%
Scope 1		
Buildings & Facilities Natural Gas/Fuel Oil	735	47.8%
Vehicle Fleet Fuels	606	39.4%
Scope 2		
Buildings & Facilities Electricity	424	27.6%
Streetlights & Traffic Signals Electricity	250	16.3%
Water Delivery Facilities Electricity	295	19.2%
Scope 3		
Employee Commute	197	12.8%

Table 15: Lower Makefield Township Scopes of Government Emissions

Lower Southampton Twp.	MTCO2E	%
Scope 1		
Buildings & Facilities Natural Gas/Fuel Oil/Propane	88	5.7%
Water Delivery Facilities Fuel Oil	2	0.1%
Vehicle Fleet Fuels	443	28.5%
Scope 2		
Buildings & Facilities Electricity	271	17.5%
Streetlights & Traffic Signals	541	34.9%
Water Delivery Facilities Electricity	102	6.6%
Scope 3		
Employee Commute	105	6.8%

Table 16: Lower Southampton Township Scopes of Government Emissions

Middletown Twp.	MTCO2E	%
Scope 1		
Buildings & Facilities Natural Gas/Fuel Oil	323	11.0%
Water Delivery Facilities Fuels	13	0.4%
Vehicle Fleet Fuels	730	24.9%
Refrigerants	20	0.7%
Scope 2		
Buildings & Facilities Electricity	690	23.6%
Streetlights & Traffic Signals	1034	35.3%
Scope 3		
Employee Commute	118	4.0%

Table 17: Middletown Township Scopes of Government Emissions

Penndel Borough	MTCO2E	%
Scope 1		
Buildings & Facilities Natural Gas	9	5.8%
Vehicle Fleet Fuels	30	19.4%
Scope 2		
Buildings & Facilities Electricity	6	3.9%
Streetlights & Traffic Signals	57	36.8%
Water Delivery Facilities	30	19.4%
Scope 3		
Employee Commute	23	14.8%

Table 18: Penndel Borough Scopes of Government Emissions

