

SWARTHMORE AREA GREENHOUSE GAS EMISSIONS INVENTORY AND ACTION PLAN PROJECT

*A report prepared by the Center for
Sustainable Communities at Temple
University*

VOLUME II: A Multi-Municipal Climate
Change Action Plan for Nether
Providence Township, Rose Valley
Borough, Rutledge Borough, and
Swarthmore Borough



SWARTHMORE AREA GREENHOUSE GAS EMISSIONS INVENTORY AND ACTION PLAN PROJECT

VOLUME II: A MULTI-MUNICIPAL CLIMATE CHANGE ACTION PLAN FOR NETHER PROVIDENCE
TOWNSHIP, ROSE VALLEY BOROUGH, RUTLEDGE BOROUGH, AND SWARTHMORE BOROUGH

A report prepared by:

***Center for Sustainable Communities
Temple University***

On behalf of

***Nether Providence Township, Rose Valley Borough, Rutledge Borough,
Swarthmore Borough, Swarthmore College, and the Wallingford-
Swarthmore School District***

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INTRODUCTION

In 2009 and 2010, the four communities of Nether Providence Township, Rose Valley Borough, Rutledge Borough, and Swarthmore Borough collaborated with Temple University's Center for Sustainable Communities, Swarthmore College and the Wallingford-Swarthmore School District to prepare a Greenhouse Gas Emissions (GHG) Inventory and a Climate Action Plan (CAP). The GHG inventory was documented in Volume I of this report and the CAP is this second volume.

The purpose of these efforts has been to document the level of emissions the residents, business owners, and municipal governments of the four communities are responsible for, as well as those of the college and school district; to set emissions reduction targets; and to identify actions that can help achieve those targets. This volume of the report builds upon the analysis conducted in the GHG emissions inventory, presenting targets for emissions reduction set by the Energy Subcommittee of the Multi-Municipal Environmental Advisory Committee (MMEAC) and a series of recommended steps to take to meet those targets.

THE CHALLENGES PRESENTED BY CLIMATE CHANGE

The American economy, like all industrialized economies in the world, is based upon the availability of inexpensive energy for construction, communications, transportation, building operations, agriculture, industry, and commerce. Most of the energy consumed in the United States 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), nitrogen oxides (NO_x), and methane (CH₄). These and other gases 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 greenhouse gases in the atmosphere are rising, global temperatures are warming, and human activities are contributing to these changes. Climate scientists believe these changes will have serious impacts on the natural environment and national and local economies. Human activities that emit greenhouse gases include not only the combustion of fossil fuels, but also agricultural production, the use of chemicals for building and vehicle cooling, the disposal of solid and liquid wastes and their subsequent decomposition, and the conversion of forests to other uses.¹

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, deteriorating air quality, declines in cows' milk production, decreases in the

¹ Anderegg, Prall, Harold and Schneider 2010, IPCC 2007 (see the References and Resources section at the end of the report for full citations).

yields of many crops, a shortening or cessation of snowmobiling and skiing seasons, and deteriorating conditions for prized hardwood trees.²

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: 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 selectively, using shared and non-motorized forms of transportation for local travel, 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 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 (or years). The GHG emissions inventory report (Volume 1) provided the baselines needed by residents, business owners, and municipal leaders in Nether Providence, Rose Valley, Rutledge, and Swarthmore to implement effective responses to climate change. This Climate Action Plan provides specific action recommendations for residents, businesspeople, elected officials, and municipal, college, and school district employees.

A SUMMARY OF THE GREENHOUSE GAS EMISSIONS INVENTORY³

Using data available from utility providers, the Delaware Valley Regional Planning Commission, and other sources, GHG emissions attributable to activities within the boundaries of the four communities of Nether Providence Township, Rose Valley Borough, Rutledge Borough, and Swarthmore Borough were calculated for the base year of 2006. Total emissions for the four communities totaled 218,236 metric tons of CO₂ equivalent emissions (MTCO₂E)⁴ in 2006. The *sectors* with the highest emissions were transportation (40%) and residential home energy use (38%)—see **Figure 1** below.

² Union of Concerned Scientists 2008.

³ See Volume I for a complete report on the project Greenhouse Gas Emissions inventory results.

⁴ 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, or 1.1 U.S. tons). Metric tons of CO₂ equivalents are usually abbreviated as MTCO₂E.

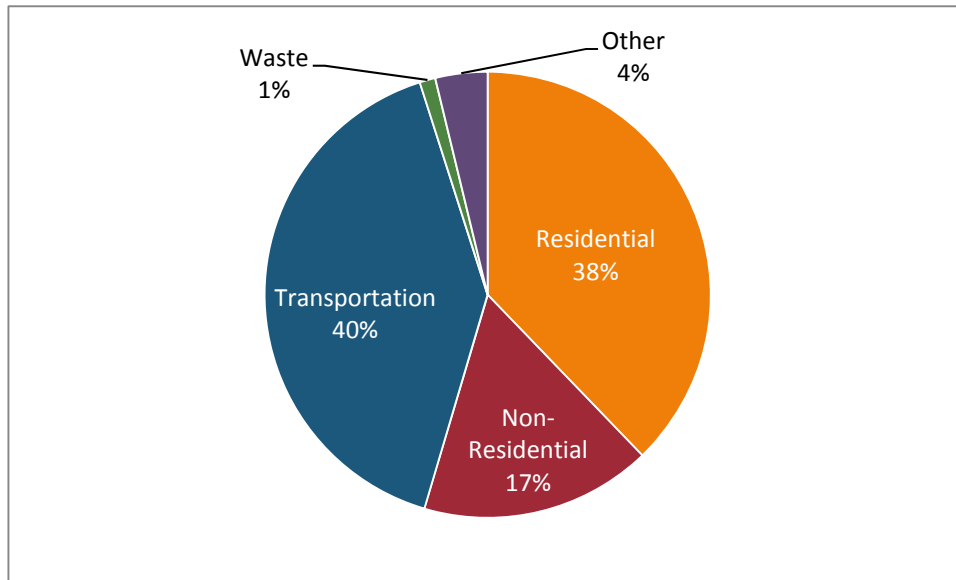


FIGURE 1: TOTAL COMMUNITY EMISSIONS (IN %) BY SECTOR, 2006

The largest *sources* of GHG emissions were gasoline (35%) and electricity (30%)—see **Figure 2** below.

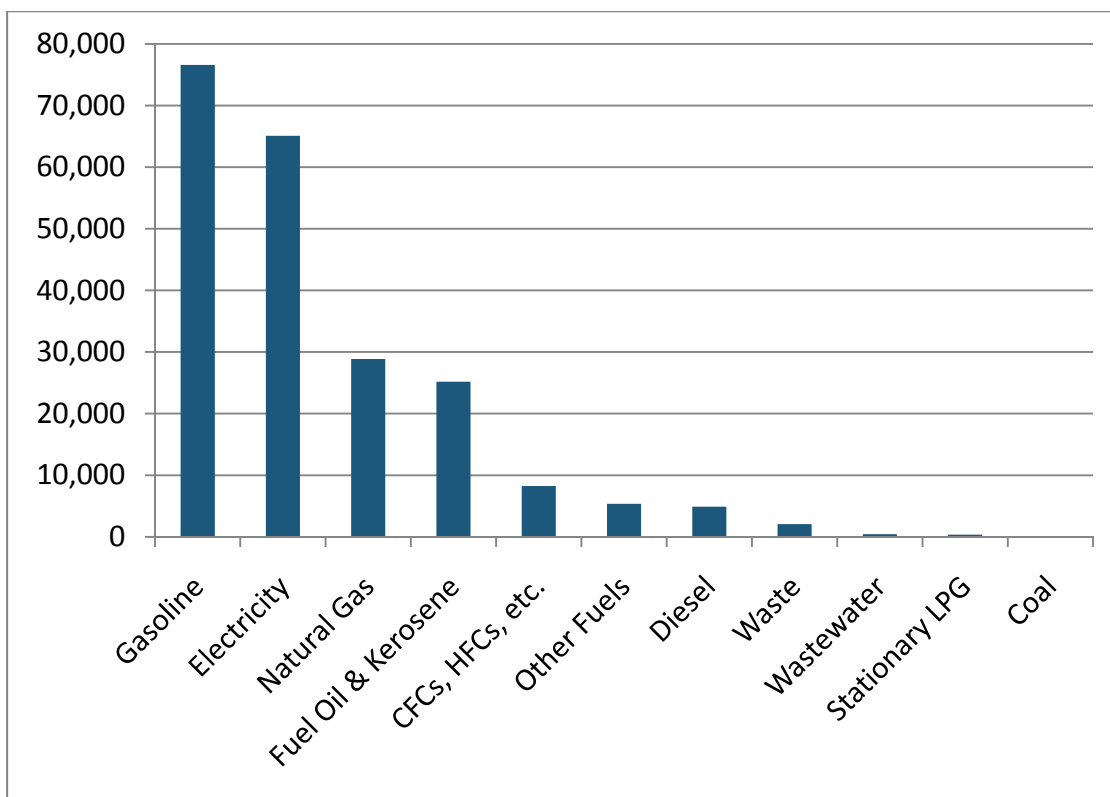


FIGURE 2: TOTAL COMMUNITY EMISSIONS (IN MTCO₂E) BY SOURCE, 2006

Municipal government facilities and operations in Nether Providence, Rose Valley, Rutledge, and Swarthmore were responsible for 1,411 MTCO₂E in 2006. Municipal government emissions come from police, fire, public works, code enforcement, administrative, and other functions.

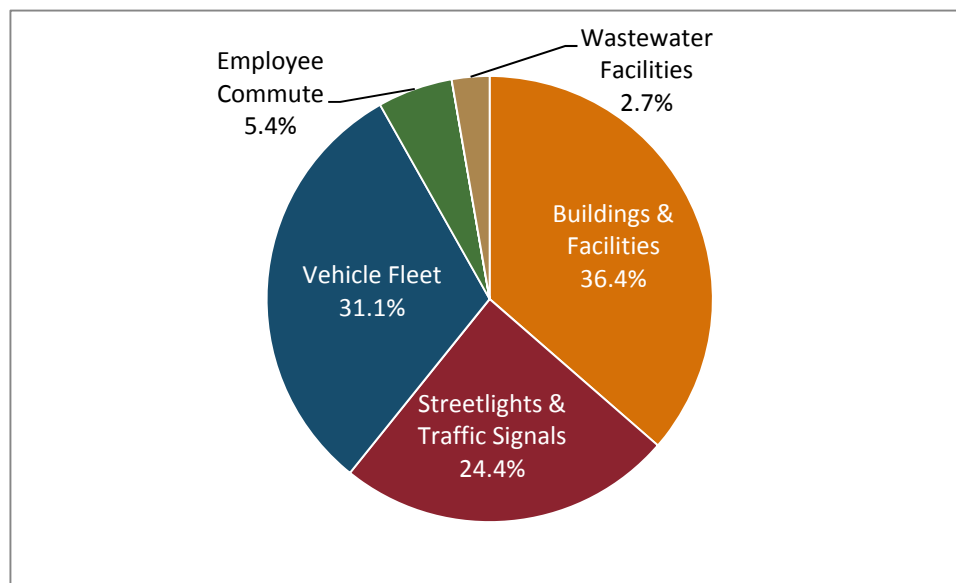


FIGURE 3: TOTAL MUNICIPAL GOVERNMENTS' EMISSIONS (IN %) BY SECTOR, 2006

Buildings and facilities make up the largest share of municipal government emissions for the four communities, with vehicle fleet and streetlights and traffic signals making up the bulk of the rest of their GHG emissions (**Figure 3**). Employee commuting, reflecting fuel used by employees to travel to and from work, estimated using the results of surveys conducted in all four municipal offices, together with wastewater facilities (in Rose Valley only), accounted for less than 10% of total emissions.⁵

GREENHOUSE GAS EMISSIONS PROJECTIONS

The Energy Information Agency of the US 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 2020.⁶ Because national 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. Compounding

⁵ Solid Waste generated by municipal government operations has not been accurately tracked by the municipal governments and their waste haulers and, therefore, reliable data were largely unavailable. Limited data available showed solid waste accounted for only 0.01% of total municipal government emissions, but this is clearly an underestimate.

⁶ Annual Energy Outlook 2010, Report #:DOE/EIA-0383(2010), Release Date: May 11, 2010, US Department of Energy, Energy Information Agency (accessed on September 8, 2010 at [http://www.eia.doe.gov/oiaf/aeo/pdf/0383\(2010\).pdf](http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2010).pdf)).

the reductions 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, Actual, 2005-2008						
	2005	2006	2007	2008		
Per capita emissions (USA) in MTCO ₂ E ^a	20.1	19.6	19.8	19.0		
Population, four communities ^b	21,106	21,059	21,071	21,103		
Per capita emissions (project communities) , in MTCO ₂ E	10.9	10.4	10.8	10.4		
Total emissions, four communities, in MTCO ₂ E ^c	229,202	218,236	227,477	220,462		
Greenhouse Gas Emissions, Projections, 2010-2035						
	2010	2015	2020	2025	2030	2035
Forecast Per capita emissions (USA) in MTCO ₂ E ^a	17.7	17.5	17.1	16.8	16.5	16.2
Forecast emissions reduction (compared to 2008)	-6.9%	-7.9%	-10.3%	-11.9%	-13.4%	-15.0%
Population, four communities ^b	21,240	21,280	21,318	21,354	21,388	21,419
Forecast per capita emissions (project communities), in MTCO ₂ E	9.7	9.6	9.4	9.2	9.0	8.9
Total emissions, four communities, in MTCO ₂ E ^c	206,647	204,805	199,797	196,536	193,432	190,111
% change in projected community emissions (2006 base)	-5.3%	-6.2%	-8.4%	-9.9%	-11.4%	-12.9%

^a Source: US Department of Energy's Energy Information Agency Annual Energy Outlook reports for 2008 and 2010.

^b Source: DVRPC Data Navigator, accessed at <http://www.dvrpc.org/asp/mcddataNavigator/>, Aug 2010.

^c Source: 2005-2008, Temple University Center for Sustainable Communities calculations. 2010 onwards, Projections.

TABLE 1: TOTAL AND PER CAPITA GHG EMISSIONS, ACTUAL AND PROJECTED, 2005-2035

The four communities of Nether Providence, Rose Valley, Rutledge, and Swarthmore are expected to have a small population increase of 0.6%, from an estimated 21,059 in 2006 to a forecast population of 21,318 in 2020 and 21,354 in 2025. If the per capita emissions for the four communities change at the same rate forecast for the United States as a whole, total GHG emissions will decrease from 218,236 MTCO₂E in 2006 to 199,797 MTCO₂E in 2020; an 8.4% drop in total emissions.

A RECORD OF ACTION

The communities of Nether Providence, Rose Valley, Rutledge, and Swarthmore have a strong record of collaboration and action to make municipal government, residences, and businesses more energy efficient and sustainable. Some of the actions they have taken, individually and collectively, include those listed in the following table.

Nether Providence Township	Swarthmore Borough
<ul style="list-style-type: none"> • Replaced all municipal building light bulbs with CFLs, all municipal building exit signs with LED lights, all incandescent bulbs in traffic lights with LEDs • Implemented an anti-idling policy for township vehicles • Purchase of renewable energy credits • Participates in the US Mayors Climate Protection Agreement, ICLEI—Local Governments for Sustainability’s Cities for Climate Protection Program, and the Sierra Club’s Cool Cities program • Outreach to the community about renewable energy • Demonstrated commitments via municipal ordinances to sound land use management, tree preservation, and land preservation • Established sidewalk committee, shade tree commission, and Environmental Advisory Council • Recycling for residents and municipal buildings 	<ul style="list-style-type: none"> • Replaced incandescent bulbs in traffic lights with LED lights • Installed solar panels on municipal building • Purchases renewable energy credits (up to 100% in 2011) • Outreach to the community about renewable energy and energy efficiency • Demonstrated commitment via municipal ordinance to sound land use management • Designated a Tree City USA, as determined by the National Arbor Day Foundation • Informal no-idling policy and minimum cooling and maximum heating policies for municipal buildings • Operations and maintenance policy requiring good upkeep of vehicles • Established a tree committee and an Environmental Advisory Council • Municipal recyclables collection for residents
Rose Valley Borough	Rutledge Borough
<ul style="list-style-type: none"> • Actively manages forest lands of approximately 40 acres of open space, including 2 wildlife sanctuaries • Demonstrated commitment via municipal ordinance to land preservation • Worked with new developer to cluster development and preserve open space, leaving a buffer between housing and wildlife preserve • Preservation of off-road foot-paths • Municipal recyclables collection for residents • Replaced mercury vapor streetlights with high pressure sodium lights (2004) 	<ul style="list-style-type: none"> • Replaced mercury-vapor street lights with high pressure sodium lamps and a low-efficiency boiler with high-efficiency gas heater • Municipal recyclables collection for residents • Stormwater detention facility built under basketball court in Triangle Park; rain garden built for additional stormwater detention • Outreach to the community about energy efficiency • Demonstrated commitment via municipal ordinance to land preservation • Actively manages forest land • Shade tree commission and informal participation in Multi-municipal Environmental Advisory Council

TABLE 2: ENVIRONMENTAL AND ENERGY INITIATIVES OF THE FOUR COMMUNITIES (PARTIAL LISTING)

The municipal governments and residents of the four communities have pursued dozens of actions to protect the natural environment and reduce energy consumption and pollutant emissions. Some of these efforts are identified in Table 2 above, demonstrating the commitments that these communities have made and the coordination that they agreed to share in the 2006 Multi-Municipal Comprehensive Plan they approved.

In addition to these community and municipal efforts, Swarthmore College and the Wallingford-Swarthmore School District have pursued environmentally responsible policies and initiatives. Swarthmore College has recently committed to reducing GHG emissions under the American Colleges and Universities Presidents Climate Commitment program, but has a long record of sustainability initiatives, including renewable energy credit purchases, upgraded lighting, water, and HVAC systems, the establishment of a campus sustainability committee and a recycling program, and other policies such as double-sided printing and reduced food packaging to reduce resource consumption. The school district has recently taken some important steps towards reductions in resource consumption as well, including the design and construction of a new middle school to be built according to LEED principles (currently they are not seeking certification) and heated and cooled geothermally.

REDUCING GREENHOUSE GAS EMISSIONS

Reducing GHG emissions at the community level must be, of necessity, a collaborative effort involving actions by individuals, households, business owners, employers, elected officials, municipal government employees, and other concerned stakeholders. We propose that responsible officials with the municipal governments of Nether Providence Township, Rose Valley Borough, Rutledge Borough, and Swarthmore Borough take the initiative in organizing and implementing a local climate change action plan (CCAP) for reducing GHG emissions that incorporates the following elements:

1. Set GHG emissions reduction targets for a first phase of implementation (already completed—see below);
2. Identify significant opportunities for reducing emissions (already completed—see below);
3. Coordinate emissions reduction efforts, including
 - Nomination of municipal government and volunteer representatives in each community to coordinate and monitor adoption and implementation of the CCAP;
 - Finalization of specific strategies to pursue between 2011 and 2020;
 - Adoption of CCAP by project communities; and
 - Implementation of CCAP strategies
4. Monitor and report on these efforts in a consistent and ongoing manner; and
5. Prepare for efforts to reduce GHG emissions beyond the first phase of reductions.

When successful, planning for and implementing GHG emissions reduction strategies benefit communities in several important ways by

- a) encouraging discussions and debate about the future of a community, its residents and businesses;
- b) mitigating the impacts of energy use on the natural environment—through reductions in pollutant emissions—and on the climate—through reductions in greenhouse gas emissions; and
- c) conserving natural resources, thus helping citizens save money by using less energy to heat, cool and clean their homes, travel, communicate, and engage in all of their other day-to-day activities.

SETTING GHG EMISSIONS REDUCTION TARGETS

Conducting a baseline inventory of GHG emissions (Phase I of this project, documented in volume 1 of this report) has been important for understanding the scope and sources of emissions present in the four communities. This analysis has provided a baseline for setting reductions goals to work towards. In collaboration with members of the Energy Sub-Committee of the communities' Multi-Municipal Environmental Advisory Committee (in which Rutledge Borough, which does not have a formally designated EAC, is a participating member) several possible emissions reduction

targets were considered. Based on these discussions and our own analysis, we recommend setting a reduction target that is feasible, but ambitious within a timeframe of ten years.

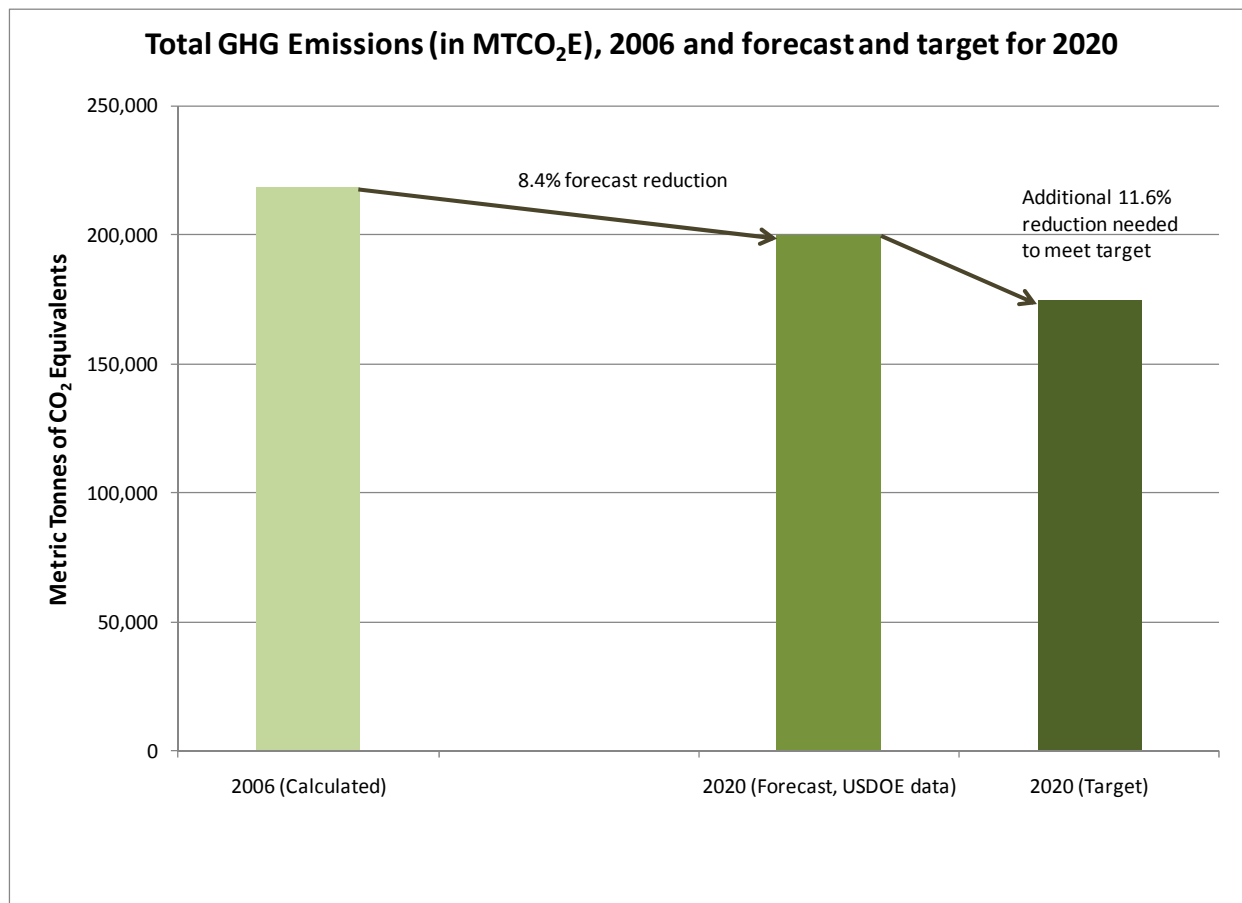


FIGURE 4: EMISSIONS FORECAST AND TARGET FOR 2020 (MTCO₂E)

Consequently, the Center for Sustainable Communities proposes that the four communities work towards emissions reductions of **20% below 2006 emissions by the year 2020**. Our projections indicate that about 8.4% of the reduction may occur without targetted efforts on the part of local leaders, residents, and business owners. As cars and trucks, home appliances, and business equipment are replaced over the next decade and the electricity grid becomes less carbon intensive, fewer GHGs should be emitted even without significant changes in behavior.

While there is significant uncertainty as to the reductions that will actually be observed in future years, technological, social, economic and political changes are likely to lead to reductions in per capita emissions that approach these forecasts. An additional 11.6% reduction in GHG emissions would have to come from more focused efforts on the part of municipal leaders, residents, business owners, and the college and school district communities (see [Figure 4](#) above) to meet the 20% by 2020 target. The recommendations in this report are aimed at achieving the full 20% emissions reductions, as some of the strategies identified in this report may include actions that would reflect the changes included in the Energy Information Agency’s models of change. Beyond 2020, more significant reductions should be made; this is discussed in more detail below.

SIGNIFICANT OPPORTUNITIES FOR GHG EMISSIONS REDUCTION

The sources of GHG emissions that represent the largest opportunities for reductions in Nether Providence Township, Rose Valley, Rutledge, and Swarthmore Boroughs in the future are:

- gasoline and diesel used for transportation (accounting for **34% to 38%** of total GHG emissions in each municipality);
- electricity used in residences, businesses, and industry (accounting for between **23% and 30%** of emissions); and
- natural gas and fuel oil & kerosene used for cooking, clothes driers and heating water and buildings (a combined share of **25% to 35%** of community emissions).

Reducing consumption of motor fuels requires 1) using more energy efficient forms of transportation (such as public transit, bicycles, walking, or smaller, more fuel efficient cars), 2) traveling less, or 3) both. Reducing electricity, natural gas, and fuel oil use requires constructing and retrofitting buildings to be more energy efficient, replacing inefficient appliances with more efficient ones, and using energy more conservatively. The strategies included below in the sections entitled *Reducing Municipal Government Emissions* and *Reducing Community Emissions* take these opportunities into account.

COORDINATION OF EMISSIONS REDUCTIONS EFFORTS THROUGH 2020

To coordinate GHG emissions reductions efforts in the four project communities, we recommend the following steps be followed:

- Identify a municipal employee and a volunteer in each community to be responsible for Climate Change Action Plan recommendations, implementation, and ongoing monitoring of progress;
- Finalize specific strategies from among those identified in this report (or others) to pursue between 2011 and 2020;
- Approve CCAP strategies to be undertaken in each of the four communities with municipal council resolutions; and
- Implement the strategies included in the adopted CCAP utilizing community volunteer assistance.

A group of citizen volunteers in Nether Providence, Rose Valley, Rutledge, and Swarthmore—including some members of the Environmental Advisory Councils of the four municipalities⁷—has been working to develop strategies for reducing GHG emissions. This group

⁷ Rutledge Borough does not have an official EAC, but has an unofficial representative who participates in the meetings of this multi-municipal Environmental Advisory Council.

and the system of working groups they have established intends to provide a framework upon which to further plan and implement GHG emissions reduction strategies in the four communities.⁸

As community members and municipal government employees continue working on the project, the following resources will help in their ongoing efforts.

- Maintain contact and collaborate with the Delaware Valley Regional Planning Commission (DVRPC), the Delaware County Planning Department, PECO's Smart Ideas program, and ICLEI-Local Governments for Sustainability (membership in ICLEI should be continued).
- DVRPC's Local Energy and Greenhouse Gas (GHG) Reduction Toolkit modules can be used to assess municipal government energy use on a building by building and vehicle by vehicle basis. DVRPC's toolkit makes use of the US EPA's Energy Star program for local governments, particularly the online "Portfolio Manager" tool that assesses energy use and energy savings opportunities for many different types of buildings and facilities local governments manage.⁹ DVRPC also has initiated an Alternative Energy Ordinance Working Group that in 2011 will be releasing model ordinances for use by communities within the Delaware Valley.
- ICLEI – Local Governments for Sustainability *Climate and Air Pollution Planning Assistant* software to evaluate fifty five separate measures was used to develop the recommendations in this report using detailed facilities, equipment, and vehicle data obtained from the four municipal governments, Swarthmore College and Wallingford-Swarthmore School District.¹⁰

ONGOING COORDINATION, MONITORING, AND EVALUATION

The municipal governments' elected officials and employees have an important role to play in providing leadership and coordination of sustainability efforts in the four communities. This first set of recommendations provides a strong foundation for all the other recommendations in the report.

- Develop and maintain a website for community communication and feedback; use the two community surveys distributed for this project as a basis for future updates and assessment of community priorities and action.
- Update GHG emissions inventories for the four municipal governments and the four municipalities on an annual basis. These updates should be kept simple by focusing only on the main sources of emissions: electricity use, natural gas consumption, and motor fuels (gasoline and diesel) used for vehicle miles traveled. These sources of emissions

⁸ This group has created working groups to focus on projects related to GHG emissions reductions in the (1) residential sector, (2) the commercial/institutional/municipal sector, and (3) with the Wallingford-Swarthmore School District. In addition, other working groups will address (4) technical, (5) policy, and (6) marketing/communications issues.

⁹ For more information, see <https://www.energystar.gov/istar/pmpam/>.

¹⁰ See <http://www.icleiusa.org/action-center/tools/cappa-decision-support-tool>. Other resources that could be useful are the Climate Manual (<http://climatemanual.org/>) and model ordinances language at http://www.nextstep.state.mn.us/res_detail.cfm?id=316.

comprise over four-fifths of calculated emissions for the years 2005-08 (fuel oil is also a significant source of emissions, but it is relatively small, compared to these three main sources and is more difficult and less reliable to estimate). Using annual updates from PECO (for electricity and natural gas consumption), obtained through DVRPC, these updates can be completed using ICLEI CACP software. While updated data on vehicle miles traveled at the municipal level will be provided by DVRPC only every five years, in the intervening years, estimates of changes in VMT can be calculated using PennDOT county-level data on highway miles traveled (as Temple University Center for Sustainable Communities (CSC) analysts did for the years 2006, 2007, and 2008 in volume 1 of this project report).

- Prepare annual updates of GHG emissions and progress towards the **20 by 2020** goal.

PREPARING FOR EMISSIONS REDUCTIONS BEYOND 2020

A twenty percent reduction in GHG emissions by 2020 would be a significant achievement and would demonstrate the ability of community residents and leaders to address the climate change challenge and reduce municipal, residents' and businesses' consumption of, and spending on, electricity, gasoline and diesel, natural gas, fuel oil, and other sources of energy. But beyond 2020, if the more ambitious reduction goals recommended by climate scientists are to be reached, much more significant reductions will be required. These are unlikely to be achievable through energy conservation alone and will likely require significant changes in zoning, building codes, land use, and travel behavior.

During the period 2011 to 2020, we recommend that members of the four communities consider revisions to the multi-municipal comprehensive plan that would incorporate these approaches to GHG emissions reductions.

REDUCING MUNICIPAL GOVERNMENT EMISSIONS

Municipal government GHG emissions reductions are under direct control of elected officials and municipal government staff members. Members of the communities' Environmental Advisory Councils have the unique role of providing guidance and suggestions informed by their keen interest in protecting and improving the natural environment.

The analytical tools identified above, particularly DVRPC's GHG Reduction toolkit modules and ICLEI's Climate and Air Pollution Planning Assistant—if used with sufficiently detailed information available from the four municipal governments, Swarthmore College, and the Wallingford-Swarthmore School District—have the potential to identify cost-effective program and policy changes to reduce municipal government GHG emissions.

In this volume of the report, Temple University's Center for Sustainable Communities has conducted preliminary analysis to identify seven promising strategies that are likely to be effective methods of achieving the "20 by 2020" GHG emissions reduction target for the four municipal governments. Each one is summarized in a text box (see the example below) that includes the estimated emissions reductions achievable, the percentages such recommendations would represent of all municipal governments GHG emissions and in 2006 and municipal governments GHG emissions in the relevant sector (for example, vehicles or buildings and facilities). A summary of these recommendations is provided in Appendix A. The CSC has worked with the data currently available, but more detailed follow-up analysis by municipal government staff members and volunteer EAC members will be needed.

When reviewing the following recommendations and conducting further analysis, community leaders should consider the following factors: time frame for implementation, ease of implementation, level of potential impact, educational value in communicating with the community and the media, cost of implementation, and return on investment. These factors will vary for each recommendation and should be assessed in collaboration with Nether Providence, Rose Valley, Rutledge, and Swarthmore's partners at ICLEI, DVRPC, Delaware County, and other agencies. DVRPC's and ICLEI's analytical tools permit consideration of all of these factors.

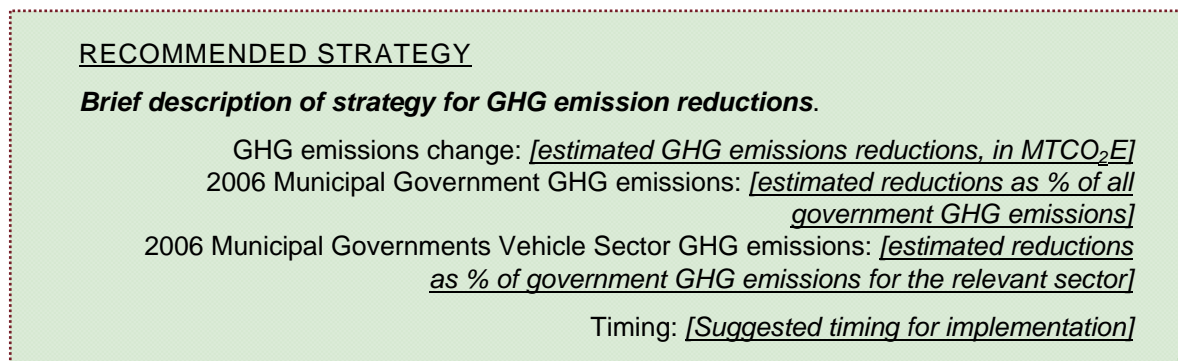


FIGURE 5: EXAMPLE OF RECOMMENDED EMISSIONS REDUCTIONS STRATEGIES

The municipal governments of Nether Providence, Rose Valley, Rutledge, and Swarthmore can be community leaders in continuing to reduce energy consumption and greenhouse gas emissions. For municipal government emissions, elected officials can take action to be more efficient with the use of energy for building and vehicle fleet operations, reducing energy consumption and saving tax dollars. By taking these actions and communicating clearly and consistently with residents and business owners, the four municipal governments will encourage and support households' and businesses' efforts to reduce their greenhouse gas emissions.

VEHICLE FLEET

31% of government emissions in 2006

The municipalities' vehicle fleets are a large source of those emissions over which the local governments have significant control. Replacing some of these vehicles with smaller and more energy efficient models that can provide the same functionality for municipal operations is a simple and effective approach to reducing GHG emissions. Preliminary analysis, based upon a fleet of about two dozen municipal cars and light duty vehicles (pick-up trucks and SUVs) in the four communities, indicates that by replacing a quarter of these vehicles with hybrids and a quarter with smaller vehicles can have a significant impact on GHG emissions.

RECOMMENDED STRATEGY: 1

Replace municipal government vehicles with hybrid gasoline/electric vehicles and smaller vehicles, where practical.

GHG emissions change: -33 MTCO₂E

2006 Municipal Government GHG emissions: -2.3%

2006 Municipal Governments Vehicle Sector GHG emissions: -7.5%

Timing: As vehicles normally replaced

¹¹

Reducing the *use* of municipal vehicles in terms of annual vehicle miles traveled is another approach to reducing GHG emissions and in many communities throughout the US has been achieved with changes in municipal police patrols. Were the equivalent of one year of a police officer's time shifted from police car patrol to bicycle or foot patrol, thousands of miles of police vehicle use would be avoided. This one year of an officer's time could be split between the two police departments (Swarthmore/Rutledge and Nether Providence).

¹¹ See Appendix A for descriptions of assumptions used in calculating estimated GHG emissions reductions for all recommendations.

RECOMMENDED STRATEGY: 2

Convert one police-officer year of time to bicycle or foot patrol.

GHG emissions change: -7 MTCO₂E

2006 Municipal Government GHG emissions: -0.5%

2006 Municipal Governments Vehicle Sector GHG emissions: -1.6%

Timing: Full implementation by 2013

Other potentially effective strategies could include formal anti-idling policies (Swarthmore Borough and Nether Providence Township, with almost all of the vehicles owned by the four communities, already have informal policies against idling) and changes in landscaping to reduce the use of small-engine equipment such as lawnmowers and leaf blowers. Depending upon the extent of engine idling that occurs today, anti-idling policies enforced for heavy duty vehicles (dump trucks, for example) and construction equipment have the potential to reduce annual GHG emissions by 2 MTCO₂E per vehicle.

BUILDINGS AND FACILITIES

36% of government emissions in 2006

Of the 513 MTCO₂E GHG emissions attributable to municipal government buildings and facilities, electricity accounts for about 58% of those emissions, with natural gas representing 36%, and fuel oil and fugitive methane comprising the remaining 6%. The four project communities have already taken some steps to increase the energy efficiency of their buildings (for example, Nether Providence Township has replaced incandescent lights with compact fluorescent and LED lights) and to generate electricity through rooftop solar cells. Still, there undoubtedly remain opportunities for making civic buildings and facilities more energy efficient.

Note that the estimations for the two strategies outlined below are preliminary, based upon information available to the Center for Sustainable Communities as part of this project. A more detailed analysis, based upon more specific information concerning the municipal buildings and facilities should be conducted using DVRPC's Local Energy and Greenhouse Gas (GHG) Reduction Toolkit and PECO's *Smart Ideas* web site (for commercial and municipal customers).

Preliminary analysis, based upon more than 35,000 square feet of municipal buildings and facilities, indicates that the potential for reducing GHG emissions by improving building insulation, upgrading HVAC systems, and replacing windows, is significant.¹²

¹² The 35,000 square feet of facilities space includes Swarthmore's town hall and public works building, Nether Providence's Township Building and Public Works Garage, and estimates of Rose Valley and Rutledge Boroughs' office space. It does not include space in the communities' fire stations or schools.

RECOMMENDED STRATEGY: 3

Energy efficiency retrofits of existing facilities.

GHG emissions change: -37 MTCO₂E
2006 Municipal Government GHG emissions: -2.6%
2006 Municipal Governments Buildings & Facilities Sector GHG emissions: -7.2%

Timing: Conduct detailed energy audits by 2012, retrofits by 2013

Preliminary analysis, based upon replacement of office equipment with more energy efficient models, the installation of room occupancy sensors, and the implementation of lights out at night policies could reduce GHG emissions and save money on electricity bills.

RECOMMENDED STRATEGY: 4

Equipment replacement and lighting policies.

GHG emissions change: -22 MTCO₂E
2006 Municipal Government GHG emissions: -1.5%
2006 Municipal Governments Buildings & Facilities Sector GHG emissions: -4.2%

Timing: Gradual, as equipment normally replaced

Other potentially effective strategies could include formally adopting LEED standards for civic building retrofits, installing green or cool roofs on civic buildings, installing water-saving toilets, and educating municipal employees on energy-saving behaviors for the workplace.

STREETLIGHTS AND TRAFFIC SIGNALS

24% of government emissions in 2006

The communities of Nether Providence, Rose Valley, Rutledge and Swarthmore have already taken some important steps to reduce energy use and greenhouse gas emissions related to streetlights and traffic signals. Most of the municipal traffic signals have been converted to LED lights which save significant amounts of energy compared to older traffic signal bulbs and a few of the communities' streetlights have been upgraded to more energy efficient high pressure sodium lamps. However, most of the over 900 streetlights use the older, less efficient mercury vapor lamps, providing an opportunity to make large gains in efficiency and, consequently, important reductions in GHG emissions.

Preliminary analysis indicates that converting the 880 streetlights in Nether Providence Township and Swarthmore Borough can save almost 11% of the total 2006 level of municipal government GHG emissions.

RECOMMENDED STRATEGY: 5

Replace mercury vapor streetlights with LED technology.

GHG emissions change: -152 MTCO₂E

2006 Municipal Government GHG emissions: -10.8%

2006 Municipal Governments Street/Traffic Lights Sector GHG emissions: -44.2%

Timing: By 2013

Another strategy to consider would be to reduce the average number of hours of street lighting from 12 to 11. While this would require coordination and negotiation with PECO, the potential savings are large and might lead to region-wide implementation and savings.

OTHER SECTORS: EMPLOYEE COMMUTE AND WASTEWATER FACILITIES

8% of government emissions in 2006

The municipal governments are only indirectly responsible for emissions from employees' commuting to work (5% of total), but reducing these emissions can help reduce total government greenhouse gas emissions. While in 2006, wastewater treatment facilities operated by Rose Valley Borough were responsible for 3% of total municipal government GHG emissions, the borough has sold these facilities and is no longer directly responsible for these emissions.

Opportunities to reduce emissions in this sector are large, as almost 90% of municipal employees commute to the workplace by driving alone. Two of 70 respondents to employee commute surveys indicated that they use public transit, three of 70 walk or bike regularly, and another six of 70 occasionally walk or bike. But encouraging changes in commuting habits is notoriously difficult to do and would require a concerted effort of regular communication and appeals, incentives (through contests, small prizes, or other recognition), and changes to office design (for example, providing a shower for employees who bicycle to work to use and secure, weather-protected bicycle parking facilities). If annual drive-alone mileage were to decrease 10% (the equivalent of every employee substituting a drive-alone round-trip commute once every two weeks), an important quantity of GHG emissions could be eliminated.

RECOMMENDED STRATEGY: 6

Encourage municipal employees to carpool, take transit, tele-commute, or bike or walk to work more

GHG emissions change: -5 MTCO₂E

2006 Municipal Government GHG emissions: -0.4%

2006 Municipal Governments Street/Traffic Lights Sector GHG emissions: -6.5%

Timing: Begin 2011

CARBON SEQUESTRATION

Tree planting programs are an important way to offset greenhouse gas emissions and to help cool homes and streets at the same time (through the process of photosynthesis, trees remove CO₂ from the atmosphere and store carbon in their wood, bark and leaves). The potential for trees to absorb carbon dioxide varies by species, age and size, but, in general, can be significant when large numbers of trees are planted and maintained.

RECOMMENDED STRATEGY: 7

Continue tree planting programs and increase the number of trees planted annually to 250.

GHG emissions change: -35 MTCO₂E
2006 Municipal Government GHG emissions: -2.5%

Timing: Ongoing

13

SUMMARY OF MUNICIPAL GOVERNMENT EMISSIONS REDUCTIONS STRATEGIES

Should these six recommendations be approved and successfully implemented, they would lead to a combined reduction of 282 MTCO₂E in GHG emissions, or 20% below 2006 emissions of 1,411 MTCO₂E.

Strategy	MTCO ₂ E Reduction
1 Replace municipal government vehicles with hybrid gasoline/electric vehicles and smaller vehicles, where practical.	-33
2 Convert one police-officer year of time to bicycle or foot patrol.	-7
3 Energy efficiency retrofits of existing facilities	-37
4 Office equipment replacement and lighting policies	-22
5 Replace mercury vapor streetlights with LED technology	-143
6 Encourage municipal employees to carpool, take transit, tele-commute, or bike or walk to work more	-5
7 Continue tree planting programs and increase the number of trees planted annually to 250.	-35
Total GHG Emissions Reduction (20% below 2006 emissions of 1,411 MTCO₂E)	-282

TABLE 3: SUMMARY OF RECOMMENDED STRATEGIES FOR MUNICIPAL GOVERNMENT GHG EMISSIONS REDUCTIONS

¹³ NOTE that these emissions reductions would not directly be subtracted from municipal government emissions calculations based on energy use. Also NOTE that if this recommended level of annual tree planting is feasible and consistent for the ten-year period, 2011-2020, the level of carbon sequestration would be considerably higher than is estimated here.

REDUCING COMMUNITY EMISSIONS

Representatives of the four municipal governments do not have direct responsibility for the greenhouse gas emissions caused by residents and businesses, but municipal government actions can have important impacts on the amounts and types of energy consumed throughout the community. Elected officials and municipal employees can take a leadership role in reducing greenhouse gas emissions by implementing the recommendations described in the previous section, thus setting an example of specific efforts that save money through lower energy use and reduce GHG emissions. What is more, through well designed promotional efforts, municipal policy changes, and long-term planning, municipal governments can help residents and business owners make their homes, businesses, and travel patterns more energy efficient. The following recommended strategies are designed to help community members achieve the **20 by 2020** GHG emissions reduction target (a 20% reduction in the 2006 levels of GHG emissions by the year 2020). A summary of these strategies can be found in Appendix B.

The eleven recommendations in this Climate Action Plan keep these roles in mind, emphasizing advisory and educational actions that can be taken in the short-term, planning efforts that may require additional time for the medium-term, and broader actions that can be accomplished in the long-term.

EDUCATION AND COMMUNICATION

The municipal governments of Nether Providence, Rose Valley, Rutledge and Swarthmore can inspire, encourage, educate, and challenge residents, business owners, and their own employees to practice energy efficiency, both to save money on energy costs and reduce greenhouse gas emissions. Such a program should begin with simple promotional strategies using existing municipal communication methods (web sites, community television, newsletters, and press releases) and coordination with PECO's *Smart Ideas* and *e-audits* energy efficiency programs and county and regional public programs, such as those coordinated by the Delaware County Planning Department and the Delaware Valley Regional Planning Commission.

RECOMMENDED STRATEGY: 8

Implement a residential energy efficiency education campaign.

GHG emissions change: -10,128 MTCO₂E
2006 Total Communities GHG emissions: -4.6%

Timing: Preliminary measures in 2011 with ongoing efforts in 2012 and beyond

¹⁴

Over time, this strategy could be strengthened with the implementation of a community energy efficiency challenge that helps residents monitor and reduce their electricity, natural gas, and fuel oil consumption. Models of such programs can be found by reviewing the 10% Challenge,

¹⁴ See Appendix B for descriptions of assumptions used in calculating estimated GHG emissions reductions for all recommendations.

the US EPA's Community Energy Challenge program, and other similar community energy challenge initiatives.¹⁵

RESIDENTIAL

38% of total community emissions

Energy use in the community's homes represents the single largest source of GHG emissions in Nether Providence, Rose Valley, Rutledge and Swarthmore. The majority of housing units in each of the four municipalities are more than 50 years old and energy efficiency is likely to be poor in many cases due to the age of structures, windows, and insulating materials. By promoting a program of retrofitting the community's houses and apartments, significant energy savings and GHG emissions reductions could be achieved. The municipal governments can use purely voluntary methods to encourage such retrofits, provide financial incentives, or require residents to make energy retrofits through a variety of programs.

Implementing a program of energy retrofits of existing residential buildings, including windows and appliance replacements, and insulation and HVAC upgrades, has a large potential for reducing residential GHG emissions. Such a program could be based upon required upgrades to renovated housing units and at point of sale. Alternatively, municipal governments can encourage such upgrades by offering low or zero interest loans to homeowners or simply by providing detailed information on energy retrofit resources that residents can access. Another approach that some communities have used is to develop a Property Assessed Clean Energy (PACE) financing program which provides loans to residents for clean energy upgrades that are repaid via additional payments added on to annual property tax assessments.

RECOMMENDED STRATEGY: 9

Implement a program of energy retrofits of existing residential buildings.

GHG emissions change: -8,948 MTCO₂E
2006 Total Communities GHG emissions: -4.1%
2006 Total Residential GHG emissions: -10.8%

Timing: 2012 to 2020

If households installed PV systems (an average of 2.5 KW) and solar hot water heaters, significant GHG emissions reductions could be achieved in the four communities. The municipal governments could provide assistance to homeowners and rental property owners in the form of advice (via the public education campaign described above), coordination with energy efficiency programs, and low or zero interest loans. In addition, in some circumstances (particularly for those currently using fuel oil furnaces), the installation of geothermal heat pumps by homeowners and business owners could also lead to significant energy savings.¹⁶

¹⁵ See examples at <http://www.10percentchallenge.org> and <http://www.epa.gov/ne/eco/energy/mitigation-efforts-epane.html#CEC>.

¹⁶ Greenhouse gas emissions reductions from geothermal heat pumps have not been included in this analysis.

RECOMMENDED STRATEGY: 10

Encourage homeowners and landlords to install solar photovoltaic (PV) systems and solar hot water heaters.

GHG emissions change: -1,888 MTCO₂E
2006 Total Communities GHG emissions: -0.9%
2006 Total Residential GHG emissions: -2.3%

Timing: 2011 to 2020

The passage of a water ordinance encouraging reductions in water usage could reduce energy consumption for water treatment and transport. The installation of low flow shower heads and water-saving toilets, modifications in yard and garden landscaping, and other changes in water usage practices could result in lower GHG emissions.

RECOMMENDED STRATEGY: 11

Water ordinance leading to reductions in water usage.

GHG emissions change: -438 MTCO₂E
2006 Total Communities GHG emissions: -0.2%
2006 Total Residential GHG emissions: -0.5%

Timing: 2012

NON-RESIDENTIAL STATIONARY

17% of Community emissions

The municipal governments of the four communities can encourage businesses to reduce energy consumption with a program similar to the residential energy efficiency education program described above in recommendation #8.

RECOMMENDED STRATEGY: 12

Implement a commercial energy efficiency education campaign.

GHG emissions change: -886 MTCO₂E
2006 Total Communities GHG emissions: -0.4%
2006 Total Communities Non-Residential GHG emissions: -2.4%

Timing: Preliminary measures in 2011 with ongoing efforts in 2012 and beyond

Swarthmore College's Sustainability Committee has set goals for achieving climate neutrality under the American Colleges and Universities Presidents Climate Commitment that are aimed at reducing emissions by 20% by 2020 (using 2005 as a base year), 30% by 2025, 50% by 2030, 75% by 2040, and 100% by 2050 (climate neutrality, net, including offsets). If their goal for 2020 is met, the College's GHG emissions will be lower by 3,440 MTCO₂E.

RECOMMENDED STRATEGY: 13

Swarthmore College GHG emissions reductions efforts.

GHG emissions change: -3,440 MTCO₂E
2006 Total Communities GHG emissions: -1.6%
2006 Total Communities Non-Residential GHG emissions: -9.4%

Timing: By 2020

TRANSPORTATION

40% of Community emissions

Some of the factors that contribute to emissions from the transportation sector in Nether Providence, Rose Valley, Rutledge, and Swarthmore are land use and zoning patterns that, in some parts of the four communities, have resulted in low residential population density, a strict separation of land uses, a low level of public transit service, and inconsistent and, in places inadequate, provision of sidewalks, pedestrian crossing lights, and bicycle lanes. While the existing design of the four communities makes it relatively easy in some parts of the four communities to travel on foot, by bicycle and using public transit, there remain opportunities to make the communities more pedestrian, bicycle, and transit friendly. Two principal approaches should be used: to encourage reductions in the overall amount of travel community residents make and changes in modes of travel from less energy efficient options (private vehicles driven with single occupants) to more energy efficient options (carpooling, public transit, walking, and bicycling).

To help residents accomplish both of these goals, the municipal governments should provide detailed information that is easy to understand and use on public transit options, safe bicycling routes, and walking and trip reduction strategies. We recommend the development of a web site and public education campaign, including challenges and local examples of successful travel behavior change.

RECOMMENDED STRATEGY: 14

Encourage reduction in vehicle miles traveled through a community low-carbon transportation education program.

GHG emissions change: -4,797 MTCO₂E
2006 Total Communities GHG emissions: -2.2%
2006 Total Communities Transportation GHG emissions: -5.4%

Timing: 2012 to 2015

The Wallingford-Swarthmore School District should consider strategies to reduce GHG emissions from transportation of staff, teachers and students to and from school. Parents, for example, could be encouraged to send children to school on school buses, rather than using their own personal vehicles. For students living within one mile of school, *Safe Routes to Schools*

programs could make walking and bicycling safer and more convenient. Staff and teachers should also be encouraged to use public transit, carpools, and non-motorized modes of transportation (walking and bicycling), whenever possible.

If one half of the 7,600 households in the four communities would switch an average of one four-mile trip per week from a car to a bicycle, one one-mile car trip per week to walking, two ten-mile car trips to transit, significant GHG emissions reductions could result.

RECOMMENDED STRATEGY: 15

Encourage residents to switch some car trips to bicycle, transit, or walking.

GHG emissions change: -1,382 MTCO₂E
2006 Total Communities GHG emissions: -0.6%
2006 Total Communities Transportation GHG emissions: -1.6%

Timing: 2012 to 2015

Encouraging residents and business owners to buy a hybrid vehicle or other high fuel-efficiency vehicle when they buy a vehicle (whether a new car from a dealer or a used car), can make a significant difference in GHG emissions from the transportation sector. Assuming 1,500 of the 15,000 vehicles in the four communities are replaced with hybrid or other very high fuel efficiency vehicles,¹⁷ almost 5,000 tons of GHG emissions could be avoided.

RECOMMENDED STRATEGY: 16

Encourage residents to purchase hybrid vehicles.

GHG emissions change: -4,934 MTCO₂E
2006 Total Communities GHG emissions: -2.3%
2006 Total Communities Transportation GHG emissions: -5.6%

Timing: 2012 to 2020

In the long run, emissions from the transportation sector can be reduced further still if land use changes in the four communities facilitate higher population densities (by permitting accessory apartments to be added to existing housing units, for example), greater mixing of appropriate land uses (housing and commercial), and the redesign of transport networks to make walking and bicycling safer and more convenient, along with improvements in public transit service to make it more frequent, extensive, convenient, safe and affordable. Such changes would require an ambitious effort to coordinate public discussion and support of some or all of these changes and to collaborate with county and regional agencies and local businesses.

¹⁷ The average household ownership of vehicles in the US is 1.92 per household. Market forecasts for hybrid vehicle sales as a percentage of all vehicle sales in 2020 is slightly over 7%, so this strategy would require efforts to go beyond expected hybrid sales in the four communities.

OTHER SECTORS

5% of Community emissions (waste, 1%, and other 4%)

Though the potential to achieve significant reductions in GHG emissions from Other emissions is low, educational and promotional efforts that increase recycling, reduce waste disposal, and ensure capture and proper disposal of refrigerants and other chemicals can reinforce actions that have larger impacts on the emissions of GHGs by maintaining a community focus on environmental responsibility, energy efficiency, and cost savings.

If a comprehensive program of recycling, composting of green waste, and waste reduction were pursued, significant reductions in GHG emissions could be achieved.

RECOMMENDED STRATEGY: 17

Reduce emissions from solid waste disposal through increased recycling, composting of kitchen and yard waste, and waste reduction.

GHG emissions change: -420 MTCO₂E
2006 Total Communities GHG emissions: -0.2%

Timing: 2012 to 2015

The final recommended strategy for reducing emissions is to promote the purchase of renewable energy. As the electricity market in Pennsylvania has been transformed in 2010 and 2011, residential and business customers have been able to select alternative providers to PECO (the utility that transmits electricity to Delaware County communities) and other long-established electric utilities. Several of these competitors to PECO offer renewably-generated electricity (from hydro-electric, solar, and wind) as a part or all of the electricity they sell to consumers. Many residential and business customers in Nether Providence, Rose Valley, Rutledge, and Swarthmore have participated in PECO wind energy program. Encouraging those customers to continue with PECO's program or another provider's green electricity program can help reduce GHG emissions from electricity use in the four communities.

RECOMMENDED STRATEGY: 18

Purchase electricity from renewable energy providers.

GHG emissions change: -6,481 MTCO₂E
2006 Total Communities GHG emissions: -3.0%

Timing: Begin in 2011, with continued promotion through 2020

One example of programs that communities have used to encourage green energy purchases is the US EPA's Green Power Communities program.¹⁸

¹⁸ See <http://www.epa.gov/greenpower/communities/index.htm>.

SUMMARY OF COMMUNITY EMISSIONS REDUCTIONS STRATEGIES

Should these eleven strategies prove successful, the goal of reducing 2006 levels of GHG emissions in the four communities by 20% by 2020 can be met, as almost 44,000 MTCO₂E will be avoided. These reductions come from greater energy efficiency: retrofits of existing buildings and buying ENERGY STAR appliances, for example, both result in lower energy requirements to do the things people are already doing (such as refrigerating food and maintaining homes and businesses at comfortable inside temperatures). These reductions will also come through behavioral changes, such as walking and bicycling for some trips that previously had been made with private cars or combining trips so that fewer miles have to be traveled to accomplish the same errands.

Table 4 summarizes the eleven community-level GHG emissions reduction strategies and the estimated changes in GHG emissions (in MTCO₂E) that can be achieved with successful implementation.

Strategy	MTCO₂E Reduction
8 Implement a residential energy efficiency education campaign	-10,128
9 Implement a program of energy retrofits of existing residential buildings	-8,948
10 Encourage homeowners and landlords to install solar PV and hot water systems and geothermal heat pumps	-1,888
11 Water ordinance leading to reductions in water usage	-438
12 Implement a commercial energy efficiency education campaign	-886
13 Swarthmore College GHG emissions reductions	-3,440
14 Encourage reduction in vehicle miles traveled through a community low-carbon transportation education program.	-4,797
15 Encourage residents to switch some car trips per week to bicycle, transit, and walking	-1,382
16 Encourage residents to buy hybrid vehicles	-4,934
17 Reduce emissions from solid waste disposal through increased recycling, composting of kitchen and yard waste, and waste reduction	
18 Green power purchases	-6,481
Total GHG Emissions Reduction (20% below 2006 emissions of 218,236 MTCO₂E)	-43,742

TABLE 4: SUMMARY OF RECOMMENDED STRATEGIES FOR COMMUNITY GHG EMISSIONS REDUCTIONS

CONCLUSION

The residents of Nether Providence Township and Rose Valley, Rutledge, and Swarthmore Boroughs have made important efforts in recent years to undertake projects for the benefit of the people, businesses, and natural environment of the four communities. Individually, each community has pursued initiatives to save energy, reduce consumption, and make the natural environment cleaner and safer. Together in 2005 and 2006 the communities collaborated on the development of a multi-municipal comprehensive plan and, more recently, with funding and assistance from the Pennsylvania Department of Environmental Protection, to undertake the Greenhouse Gas Emissions Inventory and Climate Action Plan project that this report documents.

In recent years, the people, businesses, and municipal governments of the four communities have been responsible for over 200,000 metric tonnes of carbon dioxide equivalent emissions every year—218,236 MTCO₂E in the base year of 2006. This represents the consumption of significant quantities of motor fuels, natural gas, coal, and other fossil fuels, energy use that is costly to consumers and taxpayers and contributes to changes in Earth's climate that may have serious and damaging impacts on animal and plant communities and human economic, political and social systems. Reducing those emissions, if done with care and thoughtfulness, can save money and resources and mitigate human impacts on the natural environment.

This report describes eighteen strategies that by the year 2020 can reduce annual community-wide GHG emissions by over 40,000 MTCO₂E (including municipal government emissions reductions of 291 MTCO₂E), a 20% reduction compared to emissions in 2006. Each strategy will require a concerted effort by representatives of the four municipal governments in collaboration with volunteers from the communities' Environmental Advisory Councils and other community groups. Some will be more straightforward than others—replacing existing streetlight lamps with energy-efficient LED lamps is simpler than encouraging changes in travel behavior, for example—but all hold potential to benefit the communities by reducing energy costs, mitigating environmental impacts, and providing opportunities to collaboratively plan for safer, healthier, more economically vibrant communities.

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CREDITS AND ACKNOWLEDGEMENTS

In working on this project, the staff of Temple University's Center for Sustainable Communities benefitted from the generous support and assistance of dozens of contributors from Nether Providence Township, Rose Valley Borough, Rutledge Borough, Swarthmore Borough, Swarthmore College, and the Wallingford-Swarthmore School District. The report is more detailed, accurate, and insightful for their efforts and we acknowledge their help here (while taking full responsibilities for any errors that may be present).

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APPENDIX A: MUNICIPAL GOVERNMENT GHG EMISSIONS REDUCTION RECOMMENDATIONS

Strategy	Climate & Air Pollution Planning Assistant modules	Assumptions	MTCO ₂ E Reduction	
1	Replace municipal government vehicles	<i>Hybrids and Small Vehicles</i>	Replace six vehicles from the 2011 municipal fleets with hybrid vehicles and seven with smaller, more fuel efficient vehicles. Current vehicles average mpg of 19.7 and 12,042 annual miles driven; hybrid vehicles average mpg of 46 and smaller vehicles average mpg of 29.	-33
2	Police-officer bicycle or foot patrol	<i>Bicycle Police</i>	One officer-year of bicycle patrol would reduce annual vehicle usage by 12,042 miles in a police vehicle averaging 16 mpg.	-7
3	Facilities energy efficiency retrofits	<i>Retrofits</i>	Retrofits of 35,000 square feet of municipal government facilities: 24,000 ft ² in Swarthmore Borough, 7,100 ft ² in Nether Providence Township, and an estimated 4,000 ft ² in Rutledge and Rose Valley Boroughs combined. Estimated 10% electricity savings and 10% natural gas savings.	-37
4	Office equipment replacement and lighting policies	<i>Computers, Monitors, Printers, Copiers, Refrigerators, Occupancy Sensors, and Lights Out at Night</i>	Replacement of 20 computers and monitors, 10 printers and 4 copiers with more ENERGY STAR models with typical kWh energy savings. Installation of room occupancy sensors and the implementation of lights out at night policies, both assuming 5% energy savings.	-22
5	Replace streetlights with LED technology	<i>LED Streetlights</i>	880 existing mercury vapor streetlights with an average wattage of 144 replaced with energy efficient LED lamps (assuming 12 hours of operation per day).	-152
6	Municipal employee alternative commute	<i>Reduce Fleet</i>	Reduce by 10% vehicle miles traveled for municipal employees commute (calculated 111,571 miles in 2010) by encouraging an average of one private-vehicle commute every two weeks to be replaced by bicycle, walking, or transit.	-5
7	Tree planting programs	<i>Forest</i>	250 trees planted, each absorbing 0.14 metric tons of CO ₂ annually (a conservative estimate).	-35
Total GHG Emissions Reduction (20.6% below 2006 of 1,411 MTCO₂E)			-291	

APPENDIX B: COMMUNITY GHG EMISSIONS REDUCTION RECOMMENDATIONS

Strategy	Climate & Air Pollution Planning Assistant modules	Assumptions	MTCO ₂ E Reduction
8 Residential energy efficiency education campaign	<i>Resident Efficiency Education</i>	7,600 households targeted with educational messages, average per household electricity usage of 11,000 kWh and natural gas usage of 510 therms (500 CCF), and 15% reductions in electricity and natural gas consumption.	-10,128
9 Energy retrofits of existing residential buildings	<i>Retrofits</i>	Half of the 7,600 households in the four communities make energy efficiency improvements to avg of 1,500 ft ² of living space for annual energy use reductions of 15% (electricity) and 15% (natural gas).	-8,948
10 Solar PV and hot waters systems	<i>Solar PV and Solar Hot Water</i>	7.5% of hhs install 2.5 KW PV systems w/ 5 sun hours/day; 7.5% of hhs install solar hot water heaters w/ avg daily hot water use of 50 gals and 2/3 heating savings	-1,888
11 Water use reduction ordinance	<i>Water Ordinance</i>	Reduction of 25% in water usage at the household level with an estimated current usage rate of 200 gallons per household per day.	-438
12 Commercial energy efficiency education	<i>Business Efficiency Education</i>	Each of 100 small businesses makes energy efficiency improvements that save 11,000 kWh of electricity and 510 therms of natural gas.	-886
13 Swarth. College GHG emissions reductions	NA	Swarthmore College has committed to reducing its 2005 levels of GHG emissions by 20% by the year 2020.	-3,440
14 Encourage travel reduction	<i>Trans Education</i>	7,600 households targeted with a transportation educational and marketing efforts and an average 8% reduction in vehicle miles traveled.	-4,797
15 Encourage residents to switch car trips to bikes, transit, walking	<i>Bike Paths, Walking, Increase Bus Use and Increase Rail Use</i>	Half of the 7,600 households replace one 1-mile car trip with a walk trip, one 4-mile car trip with a bicycle trip, one 9.8-mile car trip with a bus trip, and one 9.8-mile car trip with a rail trip.	-1,382
16 Encourage residents to buy hybrid cars.	<i>Hybrids</i>	10% of 15,000 vehicles (national household ownership is 1.92 vehicles / hh for 7,600 hhs) is replaced with hybrid or other very high fuel efficiency vehicles.	-4,934
17 Reduce emissions from solid waste disposal	<i>Curb Recycle, Kitchen Composting, Yard Composting, and Pay Throw</i>	Reduce solid waste disposal by 600 lbs per person per year and green waste disposal by 600 lbs per person per year.	-420
18 Green Power Purchase	<i>Green Power Purchase</i>	An average of 14% of electricity purchased (for residents and businesses) from renewable sources, assuming average annual energy use is 4,000 kWh.	-6,481
Total GHG Emissions Reduction (20% below 2006 of 218,236 MTCO₂E)			-43,742

